

*Prepared for:*

**BFI North America**

**SPECIFICATIONS  
(Volume III)**

**REMEDIAL ACTION CONSTRUCTION  
MIG/DEWANE LANDFILL SUPERFUND SITE  
BELVIDERE, ILLINOIS**

*Prepared by:*



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Project Number CHE8214

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**SPECIFICATIONS  
APPROVAL PAGE**

**Remedial Action Construction Specifications for MIG/DeWane Superfund Landfill  
Belvidere, IL**

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# **DIVISION 01 – GENERAL REQUIREMENTS**

## **SECTION 01001**

### **ABBREVIATIONS**

#### **PART 1 — GENERAL**

##### **1.01 SCOPE**

- A. This section defines abbreviations and acronyms used throughout these Specifications.

##### **1.02 DEFINITIONS**

%LEL	percentage of Lower Explosive Limit
%R	Percent Recovery
AASHTO	American Association of State Highway and Transportation Officials
ACGIH	American Conference of Governmental Industrial Hygienists
AMP	Air Monitoring Plan
ANSI	American National Standards Index
APZ	Acceptable Permeability Zone
ASTM	American Society of Testing Materials
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CHASP	Construction Health and Safety Plan
CM	Construction Management
CO	Construction Operations
COCR	Chain-of-Custody Record

CQA	Construction Quality Assurance
CQAP	Construction Quality Assurance Plan
CQC	Construction Quality Control
CRZ	Contamination Reduction Zone
E&S	Erosion and Sediment
FSP	Field Sampling Plan
H&S	Health and Safety
HASP	Health and Safety Plan
HAZWOPER	Hazardous Waste Operations
IDOT	Illinois Department of Transportation
IEPA	Illinois Environmental Protection Agency
Lead PRP	Lead Potentially Responsible Party
NIOSH	National Institute of Occupational Safety and Health
OSHA	Occupations Safety and Health Administration
PPE	Personal Protective Equipment
ppm	part per million
PVC	Polyvinyl chloride
QA/QC	Quality Assurance and Quality Control
RA	Remedial Action
RD	Remedial Design
RDWP	Remedial Design Work Plan
RI	Remedial Investigation

RI/FS	Remedial Investigation and Feasibility Study
ROD	Record of Decision
SCCP	Spill Control and Countermeasures Plan
SOW	Statement of Work
TBD	To be determined
USDOT	United States Department of Transportation
USEPA	United States Environmental Protection Agency

**PART 2 — PRODUCTS**  
(Not used.)

**PART 3 — EXECUTION**  
(Not used.)

[END OF SECTION]

## **SECTION 01010**

### **SUMMARY OF WORK**

#### **PART 1 — GENERAL**

##### **1.01 SCOPE**

- A. This project is the remedial action phase of the MIG/DeWane Landfill Superfund Site. The scope of work for this project shall satisfy the IEPA-approved Final Design, as set forth in the Drawings, Plans, Specifications, Construction Quality Assurance (CQA) Plan<sup>1</sup>, and contract terms and conditions (hereafter collectively referred to as the “Contract Documents”). The Contractor shall provide all facilities, plans, equipment, machinery, tools, materials, labor, and administration to satisfactorily construct and perform the work indicated in the Contract Documents.
- B. Summary of Work does not limit the Contractor’s responsibility to provide a complete and usable installation in accordance with the Contract Documents and IEPA-approved Final Design. The following summary of work does not necessarily list work in the order in which it will be performed, nor does the summary provide an inclusive description of the work.
  - 1. Planning and Administration.
    - a. Attend preconstruction meeting.
    - b. Perform site inspection.
    - c. Prepare and submit written project plans as required.
    - d. Obtain necessary construction-related permits.
  - 2. Preliminary Work.
    - a. Take preconstruction photographs of site and adjoining roads (number and size to be specified in RA Work Plan).
    - b. Mobilize items necessary to perform the work.
    - c. Verify existing conditions.
    - d. Install any temporary utilities and facilities such as offices, electricity, telephone, water, and sewer hookup that may be needed and as described further in these Specifications.
    - e. Perform pre-construction site survey, as specified, to establish property lines, locate all above and below ground utilities and structures, provide initial record topographic survey, and set survey control and benchmarks for use in construction.

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<sup>1</sup> The CQA Consultant shall complete the CQA activities in the CQA Plan and the Contractor shall provide information and samples in support of the CQA Plan, Drawings, and Specifications.



3. Site Work. Detailed information on the required construction are provided on the Drawings and related sections of the Specifications. A summary is provided below.
  - a. Locate all existing underground and above ground utility lines in the vicinity of the work.
  - b. Construct temporary surface water, sediment, and erosion controls and maintain as required throughout construction.
  - c. Install leachate and gas collection system.
  - d. Clear vegetation over the areas defined in the Drawings.
  - e. Strip and stockpile existing topsoil over the areas defined in the Drawings for re-use as Vegetative Soil Layer on the final cover system.
  - f. Place Clay Fill over the areas defined in the Drawings and as confirmed after the cover thickness survey is completed at the outset of construction.
  - g. Construct stormwater benches, downchutes on the landfill side slopes and stormwater ponds at locations shown on the Drawings.
  - h. Abandon the existing leachate collection system.
  - i. Remove two feet (minimum) of soil from the existing surface impoundment area and dispose it at the Designated Refuse Area shown on the Drawings.
  - j. Restore all disturbed areas to conditions shown on the Drawings or to the original condition, if not specified on the Drawings.
  - k. Remove all unused materials from the site.
  - l. Clean the site and properly dispose of debris and rubbish.
  - m. Restore any disturbed areas (roads, cover, fencing, etc.)
  - n. Disconnect all temporary utilities.
  - o. Remove any temporary structures remaining on-site and dispose of debris.

## **1.02 EXISTING SITE CONDITIONS**

### **A. Information on existing site conditions:**

#### **1. General:**

- a. Information regarding existing site conditions, topography, subsurface information, groundwater elevations, existing site facilities as applicable and similar data is supplied in the Contract Documents. The Contractor is responsible for verifying existing conditions prior to the start of work. If differing conditions are identified the Lead PRP is to be notified in accordance with the Contract Documents.

B. Existing Utilities:

1. Location:

- a. Utilities and facilities adjacent to or within the work area are shown on the Drawings and are for the convenience of the Contractor only. No responsibility is assumed by the Lead PRP or the Engineer for their accuracy or completeness.
- b. The Contractor shall verify locations of utilities and facilities, including contacting any and all utility-location services for marking utilities prior to initiating work. Immediate and adjacent areas where excavations are to be made shall be thoroughly checked.

2. Contractor's Responsibilities:

- a. Where Contractor's operation could cause damage or inconvenience to active utilities or landfill equipment (e.g. gas vents), the Contractor shall make arrangements necessary for the protection of these utilities or landfill equipment. The Contractor shall replace existing utilities or landfill equipment removed or damaged during construction at his own expense, unless otherwise provided in the Drawings.
- b. The Contractor shall notify utility offices that could be affected by construction operations at least 48 hours in advance. Under no circumstances shall the Contractor expose any utility without first obtaining permission from the appropriate agency. Once permission has been granted, locate, expose, and provide temporary support for the utilities.
- c. The Contractor shall be solely and directly responsible to the Lead PRP and operator of such utilities for damage, injury, expense, loss, inconvenience, delay, suits, actions, or claims of any character brought because of injuries or damage that may result from construction operations under this contract.
- d. Neither the Lead PRP, its representatives, nor their officers or agents shall be responsible to the Contractor for damages as a result of the Contractor's failure to protect utilities encountered in the work.
- e. In the event of interruption to domestic water, sewer, storm drain, or other utility services as a result of accidental damage due to construction operations, the Contractor shall promptly notify the proper authority. The Contractor shall

cooperate with said authority in restoration as promptly as possible and pay for repair. The Contractor shall prevent interruption of utility service unless granted by the utility Lead PRP.

- f. In the event the Contractor encounters water service lines that interfere with trenching, Contractor shall obtain prior approval of the water utility, cut the service, dig through, and restore service to previous conditions using equal materials.
- g. Drainage culverts and pipes removed by the Contractor shall be replaced in kind as specified in the Contract Documents.

3. Names of Known Utilities:

- a. Commonwealth Edison (Electricity)

C. Field relocation:

- 1. If existing structures are encountered that prevent construction as approved in the Drawings, the Contractor shall notify the Lead PRP before continuing work so the Lead PRP and the Engineer can make necessary revisions.
- 2. Where shown or directed by and acceptable to the Lead PRP, the Contractor shall provide relocation of existing facilities to include piping, utilities, equipment, structures, electrical conduit wiring, electrical duct bank, and other miscellaneous items. Contractor shall use only new materials for relocation of existing facilities, and match materials of existing facilities, unless otherwise shown or specified. The Contractor shall perform relocations to minimize downtime of existing facilities and install new portions of existing facilities, if applicable, in their relocated position prior to removing existing facilities, unless otherwise accepted by the Lead PRP.

D. Easements:

- 1. Easements, if required, shall be obtained before construction is started by the Contractor. However, should the procurement of any easement be delayed, the Contractor shall schedule work so that operations are confined to areas where easements have been obtained or are not required, until such time as easements have been secured.

2. Where portions of the work will be located on public or private property, easements and permits shall be obtained by the Contractor. Easements shall provide for use of property for construction purposes only to the extent indicated on easements. The Contractor shall provide the Lead PRP with copies of all easements and permits obtained.
- E. Connecting (tie-in) to Existing Facilities. Unless otherwise shown or specified, Contractor shall determine methods of connecting new work to existing facilities, and obtain the Lead PRP's review and acceptance of connections prior to starting the work. The Contractor shall:
  1. Determine location, elevation, nature, materials, dimensions, and configurations of existing facilities where necessary for connecting new work.
  2. Inspect existing record drawings and shop drawings, conduct exploratory excavations and field inspections, and conduct similar activities as needed.
  3. Not shutdown the existing facility prior to connection unless otherwise shown or specified or unless prior written approval is obtained.

### **1.03 CONTRACTOR'S DUTIES**

- A. The Contractor shall prepare, submit, and obtain approval by the Lead PRP for written project plans as set forth in the Contract Documents.
- B. The Contractor shall obtain pre-approval by the Lead PRP for all subcontractors.
- C. The Contractor shall obtain all necessary building, construction, and operating approvals, permits, and consents.
- D. The Contractor shall start, construct, and complete the project in accordance with the Contract Documents.
- E. The Contractor shall establish means of, and techniques and procedures for, constructing and otherwise executing the project to achieve the IEPA-approved Final Design as set forth in the Contract Documents.
- F. The Contractor shall furnish and pay all fees and costs associated with the remedial action project work, including, but not limited to the following:

1. labor and supervision;
  2. supplies, materials, equipment, tools, and machinery;
  3. water, electricity, telephone, and other utilities necessary to properly execute and complete the work;
  4. other facilities, offices, permits, and services necessary to properly execute and complete the work; and
  5. insurance, overhead and administration, and all other costs required to make the project complete.
- G. The Contractor shall not transport and dispose of materials off-site unless the Contractor has obtained approval from the Lead PRP and pays all fees and costs associated with such transportation and disposal.
- H. The Contractor shall pay costs of all legally required sales, consumer, payroll and taxes, and any governmental fees.
- I. The Contractor shall perform the work in accordance with those codes, ordinances, rules, regulations, orders, and other legal requirements of governmental bodies and public agencies which bear upon performance of the work.
- J. The Contractor shall maintain order, safe practices, and proper conduct at all times among the Contractor's employees and subcontractors.
- K. The Contractor shall coordinate activities of the suppliers and subcontractors, if any, performing the work. Work performed by subcontractors for the Contractor shall be the responsibility of the Contractor.
- L. The Contractor shall perform the work as specified and in a timely manner.

#### **1.04 CONTRACTOR'S USE OF WORKSITE**

- A. The Contractor shall confine worksite operations to those areas permitted by laws, ordinances, permits, and the Contract Documents.
- B. When determining amount, location, movement, and use of materials and equipment on the worksite, the Contractor shall consider the safety of the work and that of people and property adjacent to the worksite.
- C. The Contractor shall conduct work at the worksite and on surrounding streets and highways in a clean and orderly manner.

- D. The Contractor shall coordinate all work with any other Subcontractors on the site.

**PART 2 — PRODUCTS**

(Not used.)

**PART 3 — EXECUTION**

**3.01 SEQUENCING OF WORK**

- A. Prior to construction, the Contractor shall prepare and submit a logical sequence of the work, as described in further detail elsewhere in these Specifications. Activities which can be performed simultaneously in order to minimize the total time spent on the work shall be noted. Once the sequence of work is finalized and approved by the Lead PRP, significant deviations from the sequence of work must be pre-approved by the Lead PRP.
- B. Where existing facilities tie-ins are needed during the course of the work, Contractor shall obtain the Lead PRP's or its representative's review and acceptance of submittals for connections between new and existing work, and other related work. Contractor shall conform to other sections as applicable.

[END OF SECTION]

## **SECTION 01030**

### **CONSTRUCTION MANAGEMENT PLAN AND CONSTRUCTION OPERATIONS PLAN**

#### **PART 1 — GENERAL**

##### **1.01 SCOPE**

- A. This Section describes the project-specific Construction Management Plan (CM Plan) and Construction Operations Plan (CO Plan) which the Contractor shall prepare and submit with the bid to the Lead PRP, and shall be used by the Contractor during execution of the work.
- B. The purpose of the CM and CO Plans is to evaluate Bidders by providing the Lead PRP with information on the Contractor's intended management of the project. An additional purpose is to observe during bidding and throughout the project that the Contractor has adequate staff and organization to comply with the requirements of the Contract Documents. During the project, the CM and CO Plans are intended to provide for better communications and problem resolution.

##### **1.02 RELATED SECTIONS**

- A. Section 01300 - Submittals

##### **1.03 CONSTRUCTION MANAGEMENT PLAN**

- A. The CM Plan shall be submitted with the bid. The CM Plan shall contain the following items:
  - 1. Table of Contents.
  - 2. Description of project organization.
  - 3. Designation of the Contractor Project Manager, Site Superintendent, and other positions of responsibility.
  - 4. Organization chart.
  - 5. Communication matrix.
  - 6. Responsibility matrix.

7. List of all subcontractors.
  - a. Include description of relevant work to be performed by subcontractor.
  - b. Responsible person from each subcontractor.
8. Position descriptions for all on-site management and supervisory personnel.

#### **1.04 CONSTRUCTION OPERATIONS (CO) PLAN**

- A. ***The CO Plan shall be submitted with the bid.*** The CO Plan shall contain a Site Layout Drawing showing at a minimum the following items:
  1. Staging areas for materials handling/stockpiling.
  2. Parking Areas.
  3. Additional roadways required.
  4. Utilities routing.
  5. Storm Water Management Areas
- B. The CO Plan shall also contain a Project Schedule and Construction Sequence as set forth in Section 01310 of the Specifications.
- C. The CO Plan shall address traffic control, including items such as: (i) a description of the Contractor's proposed routes vehicles will take to and from the site; (ii) a description of how the Contractor's sequence of construction will affect use of nearby roadways; and (iii) a description of the Contractor's proposed traffic control methods (e.g., flaggers, warning signs, barricades, etc.).

#### **1.05 SITE SECURITY**

- A. The CO Plan shall also address the Contractor's site security activities, such as the following items:
  1. description of the proposed security system and its principle objectives;



2. how access to the site will be controlled and how Contractor personnel and visitors will receive authorization to enter the premises; and
  3. procedures for documenting all site visitors (e.g., log book).
- B. During the work, the Contractor shall be responsible for maintaining uninterrupted security, 24 hours per day, 7 days per week, within the project area.

#### **1.06 MODIFICATION OF THE CONSTRUCTION MANAGEMENT AND OPERATIONS MANAGEMENT PLANS**

- A. If the Contractor determines that revisions are necessary to the CM Plan or the CO Plan, the Contractor shall notify the Lead PRP 14 days prior to the date the revision would take effect and submit the revisions to the Lead PRP for review and approval. Changes to the project schedule shall be as set forth in Section 01310 of the Specifications.

#### **PART 2 — PRODUCTS**

(not used)

#### **PART 3 — EXECUTION**

(not used)

[END OF SECTION]

## **SECTION 01031**

### **COMMUNITY RELATIONS**

#### **PART 1 — GENERAL**

##### **1.01 SCOPE**

- A. This Section describes the role of the Contractor in maintaining positive community relations in the vicinity of the work site and related requirements that the Contractor shall follow.

##### **1.02 RELATED SECTIONS**

- A. Section 01030 – Construction Management Plan and Construction Operations Plan
- B. Section 01032 – Environmental Protection
- C. Section 01060 – Regulatory Compliance
- D. Section 01065 – Safety, Health, and Emergency Response Requirements
- E. Section 01300 – Submittals
- F. Section 01500 – Construction Facilities and Temporary Controls

##### **1.03 ROLE OF THE CONTRACTOR**

- A. The Contractor shall conduct work at the site in such a manner that promotes a positive public image to the members of the nearby community. In addition, the Contractor shall provide technical and logistical support to the Lead PRP concerning construction-related activities during public meetings and meetings with regulators, as necessary. The following tasks related to maintaining positive community relations shall be the responsibility of the Contractor.
  - 1. Cleanliness of the site. The Contractor shall conduct work at the site in an orderly manner to minimize the occurrence of unsightly areas such as trash and debris piles, etc. In addition, procedures shall be implemented which minimize the tracking of mud onto roadways and the generation of dust onsite, as set forth in related sections of the Contract Documents.
  - 2. Meetings. The Contractor shall attend formal and informal meetings with the general public and local officials when requested by the Lead PRP. Any meeting that includes

persons other than the Lead PRP or its representative, suppliers, or subcontractors shall be considered a community relations meeting. The Contractor's role at a community relations meeting shall be to support the Lead PRP in meeting logistics as requested and in explaining the technical aspects of equipment and operations.

3. Dissemination of Project Information. The Lead PRP or its representative will be the sole party responsible for disseminating project information. Any questions regarding site activities made to the Contractor, outside of those posed by subcontractors in performing their responsibilities, shall be referred to the Lead PRP for response.
4. Use of Local Labor. Where practical, the Contractor shall use personnel and subcontractors from the City of Belvidere, IL.
5. Notification of Authorities. The Contractor shall contact and meet on-site with the local emergency response agencies (e.g., fire department, police department, etc.) prior to start of construction. The purpose of the meeting is to inform these local authorities of the nature of the work and potential risks, to insure that the emergency responders are equipped to respond to an emergency at the site, and to identify and resolve any potential problems, concerns, or conflicts.

## **PART 2 — PRODUCTS**

(not used)

## **PART 3 — EXECUTION**

(not used)

[END OF SECTION]

## **SECTION 01032**

### **ENVIRONMENTAL PROTECTION**

#### **PART 1 — GENERAL**

##### **1.01 SCOPE**

- A. The Contractor shall provide environmental protection throughout the conduct of the work and shall specifically provide controls to prevent the occurrence of an unacceptable level of risk to public health and the environment (air, water, and land) during construction activities. The Contractor shall minimize any environmental disturbance during the work activities that would conflict with this standard. The Contractor and associated subcontractors shall comply with all applicable federal, state, and local laws and regulations relating to the activities to be performed.

##### **1.02 RELATED SECTIONS AND PLANS**

- A. Section 01060 – Regulatory Compliance
- B. Section 01065 – Safety, Health, and Emergency Response Requirements
- C. Section 01300 – Submittals
- D. Section 02105 – Erosion and Sediment Control
- E. Construction Health and Safety Plan/Contingency Plan

##### **1.03 NOTIFICATION**

- A. If the Contractor is notified of or becomes aware of any nonconformance with federal, state, or local laws or regulations, the Contractor shall immediately inform the Lead PRP of proposed corrective action and take such action as may be approved. If the Contractor fails or refuses to comply promptly, the Lead PRP may issue an order stopping all or part of the work until satisfactory corrective action has been taken. No part of the time lost due to any such stop orders shall be made the subject of a claim for extension of time or for additional costs or damages by the Contractor.

##### **1.04 PROTECTION OF LAND RESOURCES**

- A. The Contractor shall provide temporary control measures to prevent soil erosion and to prevent damage to ground cover, shrubs, or trees outside the areas of work. Erosion and sediment control measures taken by the Contractor shall fulfill all requirements of

applicable federal, state, and local regulations for erosion control and the requirements set forth in Section 02105 of the Specifications.

- B. The Contractor shall re-delineate the wetland areas shown on the Drawings minimum 30 days prior to start of earthwork.

#### **1.05 PROTECTION OF AIR RESOURCES**

- A. The Contractor shall minimize air pollution likely to occur from construction operations by maintaining effective dust-control measures, requiring proper emission control devices on construction vehicles and equipment, and by shutdown of motorized equipment when not in use.

#### **1.06 PROTECTION OF WATER RESOURCES**

- A. The Contractor shall perform activities in a manner that minimizes the potential for harmful impacts to surface water and groundwater. Measures for protection of water resources shall include providing temporary drainage facilities to prevent runoff and to control runoff from the site. These drainage features shall be maintained throughout the period of construction. The Contractor shall not dispose of any materials into any waters and shall install and maintain erosion and sediment controls (e.g., silt fences and straw bales) as needed throughout the work. Finally, the Contractor shall take whatever steps are necessary to comply with all applicable federal, state, and local regulations for erosion and sediment control.
- B. Temporary surface water management shall be performed in accordance with Section 02105.

#### **1.07 SPILL CONTROL**

- A. The Contractor shall prepare a Spill Control and Countermeasures Plan (SCCP) as set forth in Section 01065 of these specifications.

#### **1.08 NOISE CONTROL**

- A. The Contractor shall minimize noise by executing work using appropriate construction methods and equipment and only conducting work during approved work hours.
- B. Acceptable hours of work on this project are between 7:30 a.m. and 7 p.m. Monday through Saturday, unless prior approval is given by the Lead PRP.

**1.09 BURNING**

- A. Burning of refuse, demolition debris, vegetative debris including brush and trees, impacted materials, or any other material will not be permitted.

**1.10 MAINTENANCE OF MONITORING FACILITIES DURING CONSTRUCTION**

- A. The Contractor shall maintain all facilities constructed for environmental control and monitoring for the duration of the project.

**PART 2 — PRODUCTS**

**2.01 SILT FENCE**

- A. Silt fence shall be in accordance with Section 02105.

**2.02 DUST INHIBITOR**

- A. Calcium chloride can be used as a dust inhibitor. The Contractor shall provide the calcium chloride mix design to the CQA Consultant.
- B. Water, if used as a dust inhibitor, shall be obtained from sources approved by the Lead PRP.

**2.03 STRAW BALES**

- A. Straw bales shall be in accordance with Section 02105.

**PART 3 — EXECUTION**

**3.01 GENERAL**

- A. Throughout the work, the Contractor shall be prepared to use or implement the environmental protection controls and equipment described herein in the event that monitoring indicates there is a need or whenever there is concern about the potential for an unacceptable level of risk to public health and the environment (air, water and land).

[END OF SECTION]

**SECTION 01060**  
**REGULATORY COMPLIANCE**

**PART 1 — GENERAL**

**1.01 SCOPE**

- A. This Section covers the requirements for regulatory compliance on this project.

**1.02 RELATED SECTIONS**

- A. Section 01030 – Construction Management Plan and Construction Operations Plan
- B. Section 01031 – Community Relations
- C. Section 01032 – Environmental Protection
- D. Section 01065 – Safety, Health, and Emergency Response Requirements
- E. Section 01300 – Submittals
- F. Section 02105 – Erosion and Sediment Control

**1.03 GENERAL**

- A. It is the sole responsibility of the Contractor to be completely familiar with and to follow all local, state, and federal regulations pertaining to the work required in Contract Documents.
- B. The Contractor's attention is drawn to the fact that certain permits and governmental agency approvals may be required for various portions of the work. It should be expressly understood that nothing in these Specifications shall relax or modify any permit stipulation or condition of approval, and that it is the Contractor's responsibility to be fully knowledgeable of, and to comply with, all regulatory requirements affecting the work, including any and all environmental requirements.
- C. The Contractor shall be solely responsible for obtaining and complying with any and all permits necessary to perform the work. This shall include, but not be limited to, building permits, construction permits, permits for off-site debris and waste disposal, traffic and highway permits, etc. Obtaining permits will be coordinated with the Lead PRP.

- D. The Contractor shall be solely responsible for payment of any fines or penalties which may be established as a result of the Contractor's failure to comply with applicable Federal, State, and local laws.

## **PART 2 — PRODUCTS**

(Not Used.)

## **PART 3 — EXECUTION**

### **3.01 REGULATORY REPORTING DURING CONSTRUCTION**

- A. Routine regulatory reporting during construction will include monthly progress reports prepared by the CQA Consultant. The Contractor shall be aware of their required recordkeeping responsibilities as set forth in these Specifications, and shall promptly provide information as requested by the CQA Consultant for inclusion in the monthly progress report.

[END OF SECTION]



## **SECTION 01065**

### **SAFETY, HEALTH, AND EMERGENCY RESPONSE REQUIREMENTS**

#### **PART 1 — GENERAL**

##### **1.01 SCOPE**

- A. The Remedial Action (RA) Health and Safety/Contingency Plan (HAS/CP) was prepared in accordance with Geosyntec Consultants' H&S Procedures for use by Geosyntec project staff and subcontractors (if appropriate). All Contractor personnel must read and sign the RA HAS/CP or the Contractor alternately propose a Contractor's Health and Safety Plan (CHASP) prior to working on the Site.
- B. An Emergency Response Plan has been included in the RA HAS/CP.
- C. Compliance with the RA HAS/CP shall represent the minimum requirements to be met by the Contractor, who shall be responsible for examining all requirements and determining whether additional or more stringent health, safety and security provisions are appropriate for their portion of the work and implementing them accordingly. After review of the RA HAS/CP, the Contractor may choose to adopt the RA HAS/CP and Emergency Response Plan or propose an alternate CHASP. The CHASP is required to comply with all applicable and appropriate federal, state, and local laws, standards, and regulations. The Contractor is responsible for meeting all its obligations pertaining to the accuracy, content and suitability of the CHASP adopted for its work, and for the health and safety of onsite personnel.

##### **1.02 RELATED SECTIONS AND PLANS**

- A. Section 01031 – Community Relations
- B. Section 01060 – Regulatory Compliance
- C. Section 01066 – Air Monitoring
- D. Section 01300 – Submittals

##### **1.03 APPLICABLE PUBLICATIONS, REGULATIONS, GUIDELINES, AND STANDARDS**

- A. Work performed shall be consistent with the guidelines and references cited herein and in compliance with all applicable regulations and standards including, but not limited to, those listed below. In the case that these requirements are conflicting, the one which offers the greatest protection shall be followed.

B. Occupational Safety and Health Administration (OSHA) Regulations:

1. 29 CFR § 1910 General Industry Standards.
2. 29 CFR § 1915.100 Air Contaminants.
3. 29 CFR § 1926 Construction Industry Standards.

C. National Institute of Occupational Safety and Health (NIOSH) Publications:

1. 85-115 Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities.

D. American Conference of Governmental Industrial Hygienists (ACGIH) Publications:

1. Current edition of Threshold Limit Values and Biological Exposure Indices.

E. American National Standards Institute (ANSI).

#### **1.04 HEALTH AND SAFETY PLAN**

A. General:

Three copies of the CHASP, or notice of review of and adoption of the RA HAS/CP, shall be submitted to the Lead PRP for review and comment no later than 14 days prior to the start of work. The CHASP shall establish, in detail, the protocols necessary for the recognition, evaluation, and control of all hazards associated with each task performed by the Contractor and all subcontractors. The CHASP shall address site-specific safety and health requirements and procedures based upon site-specific conditions. The level of detail provided in the CHASP shall be tailored to the type of work, complexity of operations, and hazards anticipated. Once review is completed by the Lead PRP as described below, eight copies of the finalized CHASP (if different than the RA HAS/CP) shall be provided to the Lead PRP.

B. Topics:

All topics required by OSHA standard 29 CFR § 1910.120(b) (4) and those discussed below shall be addressed in the CHASP. When the use of a specific topic is not applicable to the project, the CHASP shall include a statement to justify its omission and establish that the topic was given adequate consideration.

C. Review:

The Lead PRP will review the CHASP, or notice of review of and adoption of the RA HAS/CP, and will transmit comments to the Contractor. It will be the responsibility of the Contractor to incorporate appropriate comments from the Lead PRP into the CHASP. The Contractor will not be permitted to initiate site work until the comments have been addressed and the CHASP has been reviewed by the Lead PRP. Approval of the CHASP indicates only that the CHASP complies with the requirements of this Section and does not imply that all procedures are suitable for the required work. Suitability of the CHASP for the work is the responsibility of the Contractor.

D. Modifications:

Should any unforeseen hazard become evident during the performance of the Work, the Contractor's Health and Safety Officer (HSO) shall bring such hazard to the attention of the Lead PRP, both verbally and in writing, for resolution as soon as possible. In the interim, the Contractor shall take necessary action to re-establish and maintain safe working conditions in order to safeguard on-site personnel, visitors, the public, and the environment. Should the Contractor seek modification of any portion or provision of the CHASP, such modification shall be requested by the HSO in writing to the Lead PRP and if approved, be authorized in writing. Any disregard for the provisions of this Section and the approved CHASP shall be deemed just and sufficient cause for ordering all work to cease until the matter has been rectified to the satisfaction of the Lead PRP.

E. Site Description:

The CHASP shall include a site description that addresses the following elements, as a minimum:

1. Location and approximate size of the site.
2. Site topography and accessibility by road.
3. Present status and capabilities of emergency response teams that would provide assistance to site employees at the time of an emergency.

F. Hazard/Risk Analysis:

The CHASP shall include a hazard/risk analysis that addresses the following elements, as a minimum:

1. Description of on-site jobs/tasks to be performed.

2. Duration of planned site activities.
  3. Chemical, physical, biological, and safety hazards of concern for each site task and/or operation to be performed (Task Hazard Analysis). Potential hazards that may be encountered during site work are listed below. This is not intended to be a complete list. The Contractor shall research and use additional sources of information when preparing the "Hazard/Risk Analysis" section of the CHASP.
    - a. Anticipated, known, and recognized hazards associated with all construction, remediation, and related work of the Contractor for this project.
    - b. Exposure to waste, contaminated soil, sediment, surface water, or groundwater during site work involving intrusive operations (i.e., demolition, trenching, excavation, and grading operations).
  4. Pathways for hazardous substance dispersion.
  5. Chemical, physical, and toxicological properties of the contaminants on the select list, sources and pathways of worker exposures, anticipated on and off-site exposure level potentials, and regulatory (including federal, state, and local) or recommended protective exposure standards.
  6. Exposure to hazardous substances brought on-site for the purpose of executing this work. If hazardous substances are used in executing the work, the Contractor shall comply with the requirements of 29 CFR § 1910.1200, Hazard Communication.
- G. Staff Organization, Qualification, and Responsibilities:
1. The Contractor shall develop an organizational structure that sets forth lines of authority, responsibility, and communication. The CHASP shall include a description of this organization, qualifications, and responsibilities of each of the following individuals.
  2. Certified Industrial Hygienist (CIH):
    - a. Qualifications. The Contractor shall utilize the services of an Industrial Hygienist certified in comprehensive practice by the American Board of Industrial Hygiene to develop and implement the CHASP.

3. Health and Safety Officer (HSO).

- a. Qualifications. The Contractor shall designate an individual to be the Health and Safety Officer (HSO). The HSO shall be experienced in developing and implementing health and safety programs at hazardous waste construction/remediation sites or in the petrochemical industry.
- b. Responsibilities. The HSO shall:
  - i. ensure that the procedures and requirements set forth in the CHASP are implemented by Contractor personnel;
  - ii. conduct the Contractor site health and safety meetings;
  - iii. conduct safety audits/inspections as required by the CHASP and as otherwise needed; and
  - iv. coordinate and oversee the Contractor's employee health and safety training program for the project and maintain a current recordkeeping system for Contractor employees.

H. Personal Protective Equipment:

- 1. The CHASP shall address the required personal protective equipment (PPE) required for Contractor personnel for the types of work activities and their health and safety concerns, and shall meet or exceed the minimum PPE requirements set forth in the RA HAS/CP.

I. Exposure Monitoring/Air Sampling:

- 1. The CHASP shall address the required exposure monitoring/air sampling that will be performed by the Contractor during the work. The level of monitoring/sampling shall meet or exceed the requirements set forth in the RA HAS/CP.

J. Standard Operation Safety Procedures, Controls, Work Practices:

- 1. The CHASP shall address the controls and safe work practices to be implemented for the work covered by these Specifications. These shall include, but not be limited to the following:
  - a. Site rules/prohibitions (buddy system, eating/drinking/smoking restrictions, etc.)
  - b. Protocols for operation of heavy construction equipment in accordance with 29 CFR § 1926.

- c. Descriptions of safety inspection and preventative maintenance requirements for the operation of machinery or mechanized equipment, traffic control, including written inspection reports.
- d. Utility clearances.
- e. Site "housekeeping".
- f. Fall protection.
- g. Safe clearance.
- h. Sanitation (in accordance with 29 CFR § 1910.120(n)).
- i. Electrical hazards.
- j. Communication.
- k. Excavation and trenching. Include provisions to maintain dust emissions at a minimum level.

K. Site Control and Work Zones:

1. General. In order to control the potential spread of contaminants and the flow of personnel and materials into and out of the work area, the Contractor shall establish a site control sections in the CHASP. This section shall describe the methodology to be used by the HSO in determining the modification of work zone designations, procedures to limit the spread of contamination, and general limitations to be observed by site personnel. The Contractor shall clearly layout and identify the work zones in the field and shall limit equipment, operations, and personnel in the zones as required by these Specifications and described in the CHASP.
2. Support Zone. The Support Zone (SZ) shall be established on the site and is defined as the area outside the zone of significant contamination (waste and contaminated soil). The SZ shall be clearly delineated and shall be secured against active or passive contamination from the work site.
3. Contamination Reduction Zone (CRZ). The CRZ shall serve as the personnel and equipment decontamination area. The decontamination facilities shall be located within the CRZ.

4. Exclusion Zone (EZ). The EZ boundary shall be set by the Contractor so that it encompasses areas around individual intrusive construction activities being performed. The Contractor shall control entry into this area and exit may only be made through the CRZ.

L. Decontamination:

1. The Contractor shall establish decontamination procedures for on-site personnel who perform activities in the Exclusion Zone and for equipment utilized in the Exclusion Zone. Decontamination shall be performed in the CRZ prior to entering the Support Zone from the Exclusion Zone. The Contractor shall refer to Chapter 10.0 of the technical guidance publication "Occupational Health and Safety Guidance Manual for Hazardous Waste Site Activities" (NIOSH 85-115) when preparing these procedures. Procedures shall be described in the CHASP. The Contractor shall train employees in the procedures and enforce the procedures throughout site operations.
2. All contaminated soils and decontamination fluids shall be contained and collected to prevent contaminant migration.
3. Decontamination Equipment. The Contractor shall provide the following equipment and technical information that demonstrates their suitability for the wastes to be encountered at the site.
  - a. Decontamination wash solution pumps including pump curves.
  - b. Hoses for cold water/wash solution and hot water wash/steam (if necessary for certain types of waste) including materials, pressure and temperature ratings.
  - c. Portable water heating equipment, if necessary for certain types of waste, including temperature operating range, fuel and safety considerations
  - d. Nozzles equipped with a shutoff valve or lever and capable of being adjusted to operate as a spray or stream discharge and a full range in between.
  - e. An existing decontamination pad is present at the southwest corner of the site and is available for use by the Contractor if deemed suitable for the Contractor's decontamination activities. The Contractor shall construct temporary decontamination pads as needed. This temporary pad shall have sufficient strength and size to accommodate any piece of equipment that might contact hazardous substances, a sump or other means of containing and collecting the generated wastewater, and provisions to minimize over-spray and prevent additional site contamination. Geomembrane liners used to construct the

decontamination pad shall be constructed of HDPE material of a minimum thickness of 60 mils. All field seams shall be welded as per manufacturer's recommendations. Puncturing or tearing of the material shall be avoided by placement on a firm foundation with geotextile cushions below and above the liner. The decontamination pad shall also have a 6-inch thick road surface course placed over the upper geotextile cushion to avoid puncturing or tearing of the geomembrane while under use. The Contractor may use other equivalent or better systems, which meet the performance criteria, with the approval of the CQA Consultant. The Contractor shall provide necessary drawings and details to demonstrate equivalency of the proposed alternative decontamination pad system.

M. Emergency Equipment and First Aid:

1. The CHASP shall describe the emergency and first aid equipment to be utilized.

N. Emergency Response and Contingency Procedures:

1. General. The Contractor shall prepare an Emergency Response Plan (incorporated into CHASP) in compliance with 29 CFR § 1910.120(1).
2. The CHASP shall address contingency procedures for handling drums if encountered during the work.
3. During the Remedial Action, any fuel or fluids mobilized to the site for the maintenance and operation of the contractors' equipment shall be properly stored within dual-walled containers and/or containment areas. The Contractor shall prepare a Spill Control and Countermeasures Plan if aboveground storage of petroleum products (containers with 55-gallon capacity or larger) will at any time exceed a total volume of 1,320 gallons of petroleum products. This plan shall be incorporated into the CHASP, and shall address the following elements as a minimum:
  - a. Contingency measures for potential spills and discharges from materials handling and/or transportation.
  - b. A description of the methods, means, and facilities required to prevent contamination of soil, water, air, and uncontaminated structures, equipment, or material by spills or discharges.
  - c. A description of the equipment and personnel necessary to perform emergency measures required to contain any spillage and to remove spilled materials and soils



or liquids that become contaminated due to spillage. This collected spill material must be properly disposed.

- d. A description of the equipment and personnel to perform decontamination measures that may be required to previously uncontaminated structures, equipment, or material.
4. Notification of Authorities. The Contractor shall contact and meet on-site with the local emergency response agencies (e.g., fire department, police department, etc.) prior to start of construction. The purpose of the meeting is to inform these local authorities of the nature of the work and potential risks, to insure that the emergency responders are equipped to respond to an emergency at the site, and to identify and resolve any potential problems, concerns, or conflicts.

#### **1.05 TRAINING**

- A. All employees working on-site with the potential for exposure to hazardous substances, health hazards, or safety hazards shall meet the minimum training and documentation/certification requirements as specified in 29 CFR § 1910.120.

#### **1.06 MEDICAL SURVEILLANCE**

- A. General:

The CHASP shall describe the medical monitoring program including scheduling of examinations, certification of fitness, compliance with OSHA requirements, and information provided to the occupational physician. The Contractor shall ensure the occupation physician performs the medical examination prescribed in 29 CFR § 1910.120 for workers performing work in areas other than the SZ.

#### **1.07 FIRST AID AND MONITORING EQUIPMENT**

- A. Contractor shall provide all medical, first aid, and environmental monitoring equipment to be used at the site.

#### **1.08 PERSONAL PROTECTIVE EQUIPMENT**

- A. Contractor shall supply all personal protective equipment (PPE) necessary to be in compliance with the CHASP for all site personnel. Contractor shall make available PPE for use by the IEPA, CQA Consultant, and other site visitors.

## **1.09 LOGS, REPORTS, AND RECORDKEEPING**

- A. General: The Contractor shall maintain logs and reports covering the implementation of the CHASP and other requirements of this section. The formats shall be developed by the Contractor and submitted as part of the CHASP.

## **PART 2 — PRODUCTS**

(Not used.)

## **PART 3 — EXECUTION**

### **3.01 IMPLEMENTATION OF THE CHASP**

- A. It shall be the sole responsibility of the Contractor to ensure that all health and safety requirements are implemented for all aspects of the Contractor's work in accordance with the CHASP and applicable regulations.
- B. If the Lead PRP or its authorized representative determines that the Contractor's HSO is not providing adequate health and safety controls, the Contractor shall provide alternate personnel subject to the approval of the Lead PRP and IEPA to serve as HSO. The Lead PRP or its authorized representative shall have the right to stop work for health and safety related concerns.

[END OF SECTION]

## **SECTION 01300**

### **SUBMITTALS**

#### **PART 1 — GENERAL**

##### **1.01 DESCRIPTION**

- A. This Section covers the requirements for Contractor submittals, including types of submittals, submittal procedures, review procedures, timeliness, etc.
- B. A summary of the major project submittals is provided in this section for the Contractor's convenience, and is not an all-inclusive list of required submittals. It is the Contractor's sole responsibility to meet all submittal requirements set forth in each individual section of the Specifications and other Contract Documents.

##### **1.02 TYPES OF SUBMITTALS**

- A. Submittals include, but are not limited to, the following:
  - 1. Plans. Plans include the specific written narrative plans as set forth in the Contract Documents. Plans shall be written by the Contractor for submittal as specified herein.
  - 2. Administrative Submittals. Administrative submittals include, but are not limited to:
    - a. meeting agenda;
    - b. meeting minutes;
    - c. project delivery strategy;
    - d. schedules;
    - e. project photographs;
    - f. project record documents; and
    - g. warranties and guarantees on work, equipment, and facilities;
  - 3. Technical Submittals. Technical submittals include, but are not limited to:
    - a. as-constructed data;

- b. site surveys;
- c. environmental monitoring data;
- d. manufacturer's specifications;
- e. certificates of compliance;
- f. catalogs, or parts thereof, of manufactured equipment;
- g. operations and maintenance manuals of manufactured equipment;
- h. shop drawings;
- i. performance tests on materials and equipment; and
- j. laboratory and field quality control test results.

### **1.03 QUALITY**

- A. Submittals shall be reproducible with every line, character and letter clearly legible, and usable for further reproduction to yield legible hard copy.
- B. Documents submitted to the Lead PRP that do not conform to these requirements will not be accepted. If conforming submittals cannot be obtained, such documents shall be retraced, redrawn, or photographically restored as may be necessary to meet such requirements. Contractor's failure to initially satisfy the legibility and quality requirements will not relieve Contractor from meeting the required schedule for submittals.
- C. Submittals shall be complete with respect to design criteria and other information specified to enable the Lead PRP to review the information effectively.

### **1.04 LANGUAGE AND DIMENSIONS**

- A. All words and dimensional units shall be in the English language and units.
- B. Metric dimensional unit equivalents may be stated in addition to the English units and the associated requirements.

## **1.05 DAILY WORK ACTIVITY RECORDS**

- A. Daily work activity summary reports shall be prepared by the Contractor each working day and shall include the following:
1. QC observation and test records;
  2. reports on any emergency response actions;
  3. manifest documents to include truck-load tickets and shipping papers;
  4. description of all site work;
  5. chain-of-custody documents;
  6. all laboratory reports and field test data;
  7. air emission test reports;
  8. accident and safety reports;
  9. reports on spill incidents;
  10. meteorological records;
  11. daily inspection records; and
  12. site survey data.
- B. The Contractor shall document all of the above items on a daily basis, and the information shall be submitted to the Lead PRP immediately upon request. The Daily Work Activity Records shall be part of the Project Record Documents maintained throughout the work and submitted to the Lead PRP at completion (see Section 01700).

## **PART 2 — PRODUCTS** (Not used.)

## **PART 3 — EXECUTION**

### **3.01 GENERAL REQUIREMENTS**

- A. The Contractor shall submit to the Lead PRP, and others as required for their review and approval, submittals required by the Contract Documents. All such items required to be submitted for review shall be furnished by and at the expense of the Contractor and any work affected by them shall not proceed until approval is received. Submittals and their contents shall be properly prepared, identified, and transmitted as provided herein or as otherwise directed.

### **3.02 SUBMITTAL REVIEW TIME**

- A. Unless stated otherwise for a specific item herein, not less than fourteen (14) days shall be assumed for the review of submittals. Review of submittals by the Lead PRP should not cause a delay in the work. Extension of the contract time will not be granted because of the Contractor's failure to make timely and correctly prepared and presented submittals with allowance for the checking and review periods.

### **3.03 DEVIATIONS**

- A. At the time of the submission, the Contractor shall give notice in writing in the submittal of any deviation from the requirements of the Specifications. The deviations shall be clearly indicated or described including all other changes required to correlate the work. The Contractor shall state in writing all variation in costs occasioned by the deviations and his assumption of the cost of all related changes if the deviation is approved.

### **3.04 METHOD OF SUBMITTAL**

- A. The Contractor shall deliver submittals by means of dated, signed, and sequentially numbered transmittals identified as to initial or resubmittal status, and fully describing the submittal contents. Submittals are not acceptable directly from subcontractors, suppliers, or manufacturers. In each transmittal, the Contractor shall state the project number and name, name and address of the Contractor, name and address of the subcontractor, manufacturer, supplier or distributor as applicable, and the Plan and/or Specification section reference and paragraphs to which the submittal pertains. Accompanying data sheets, catalogs, and brochures shall be identified in the same manner. Where several types or models are contained in the literature, the Contractor shall delete nonapplicable portions or specifically

indicate which portions are intended and applicable. Submittal transmittals shall fully index all items submitted.

1. Incomplete submittals, including those not correctly transmitted, not correctly titled and identified, or not bearing the Contractor's review and approval stamp, will be returned to the Contractor without review.
2. Except where the preparation of a submittal is dependent upon the approval of a prior submittal, all submittals pertaining to the same class or portion of the work shall be submitted simultaneously.
3. Submittals shall be provided to the Lead PRP by electronic mail.

### **3.05 CONTRACTOR'S REVIEW AND APPROVAL STAMP**

- A. Every submittal shall bear the Contractor's review and approval stamp certifying that the Contractor: (i) has reviewed, checked, and approved the submittal; (ii) coordinated the contents with the requirements of the work and the Contract Documents including related work; (iii) determined and verified all quantities, field measurements, field construction criteria, materials, equipment, catalog numbers, and similar data; and (iv) stated the work covered by the submittal is recommended by the Contractor and the Contractor's guarantee will fully apply thereto. The Contractor's stamp shall be dated and signed by the Contractor in every case.

### **3.06 REVIEW AND APPROVAL**

- A. The approval of submittals shall not relieve the Contractor of responsibility for any deviation from the requirements of the Contract Documents or for any revision in resubmittals unless the Contractor has given notice in writing of the deviation or revision at the time of submission (or resubmission) and written approval has been given of the specific deviation or revision. Nor shall any approval relieve the Contractor of responsibility for errors or omissions in the submittals or for the accuracy of dimensions and quantities, the adequacy of connections, and the proper and acceptable fitting, execution, and completion of the work.

### **3.07 CORRECTIONS AND RESUBMITTALS**

- A. The Contractor shall make all required corrections within five (5) days or as specified elsewhere in the Specifications, and shall resubmit the required number of corrected

submittals until approved by the Lead PRP. The Contractor shall direct specific attention in writing to revisions other than the corrections called for on previous submittals. The Contractor shall state, in writing, all variations in costs and his assumption of the cost of related changes. Each resubmittal shall be identified with the number of the original submittal followed by consecutive numbers starting with "01" for first resubmittal, "02" for second resubmittal, etc. The Lead PRP reserves the right to deduct money from the Contractor to cover the cost of its review time beyond the second submission.

### **3.08 CHECK OF RETURNED SUBMITTALS**

- A. The Contractor shall check returned submittals for correction and ascertain if the corrections result in extra cost to him above that included under the Contract Documents. If in the Contractor's opinion, extra costs result from corrections to the submittals, he shall give written notice to the Lead PRP within five (5) days. By failing to so notify the Lead PRP, the Contractor waives all claims for extra costs resulting from required corrections.

### **3.09 CONFORMANCE**

- A. No work represented by required submittals shall be purchased or commenced until the applicable submittal has been approved. Purchases may be made at the sole risk and expense of the Contractor. Work shall conform to the approved submittals and all other requirements of the Contract Documents unless subsequently revised by an appropriate modification, in which case the Contractor shall prepare and submit revised submittals as may be required. The Contractor shall not proceed with any related work which may be affected by the work covered under submittals until the applicable submittals have been approved, particularly where machinery, equipment, grading and the required arrangements and clearances are involved.

### **3.10 CERTIFICATES OF COMPLIANCE**

The material or equipment manufacturer shall certify in writing that the material supplied is in compliance with the requirements stipulated in the Contract Documents and these Specifications.



[END OF SECTION]

## **SECTION 01310**

### **PROGRESS SCHEDULES AND PROJECT MEETINGS**

#### **PART 1 — GENERAL**

##### **1.01 SCOPE**

- A. Project Schedule: Throughout the project, the Contractor shall furnish graphic type construction progress schedules, listing trade divisions and all parts of work, and showing the planned work sequence and starting date and completion time for each part of work.
- B. Project Meetings: Throughout the project, the Contractor shall participate in project meetings to discuss items such as progress, upcoming activities, sequencing of work, health and safety, etc.

##### **1.02 RELATED SECTIONS**

- A. Section 01300 – Submittals

##### **1.03 SUBMITTALS**

- A. The Contractor shall submit a preliminary construction progress schedule that conforms to the format and content requirements of this Section with their bid.
- B. The Contractor shall submit an updated construction progress schedule at the preconstruction meeting.
- C. The Contractor shall also submit a resource-loaded schedule at the preconstruction meeting.
- D. After construction starts, the Contractor shall submit revised progress schedules on at least a bi-weekly basis. In addition, a revised progress schedule shall be submitted whenever critical path activities extend beyond the contract completion date.
- E. All submittals shall be made in accordance with Section 01300 of these Specifications.

##### **1.04 FORM OF SCHEDULES**

- A. The schedules shall be graphical Gantt (bar) charts using the Critical Path Method (CPM) with the characteristics listed below.

1. Each major work element shall be represented. Significant subtasks shall be broken out from each major work element.
2. The time scale shall indicate the first work day of each week.
3. The diagram shall allow space for notations.
4. The minimum diagram size shall be 11 x 17 inches.
5. Tasks shall be listed in essentially chronological order, with the activities that are to occur first given at the top of the schedule.
6. The critical path shall be clearly indicated.

## **1.05 CONTENT OF SCHEDULES**

- A. Each Progress Schedule shall show:
1. the complete sequence of work by activity;
  2. the dates for the beginning and completion of each major element of work and the sequence of significant subtasks; and
  3. the projected percent completion for each item, as of the first day of each month.

## **1.06 PROGRESS UPDATES**

- A. Each revised schedule shall include the following, at a minimum.
1. Progress of each activity to date of submission.
  2. Changes occurring since the previous schedule submission including:
    - a. major changes in scope;
    - b. activities modified since previous submission;
    - c. revised projections of progress and completion; and
    - d. other identifiable changes.
  3. A narrative report as needed to define:
    - a. problem areas, anticipated delays, and impacts on schedule;
    - b. corrective action recommended and its effect; and
    - c. effect of changes on schedules of other contractors.

## **1.07 PROJECT MEETINGS**

- A. Pre-construction Meeting.
1. The meeting will be held at a location to be designated by the Lead PRP.

2. The Contractor and all major subcontractors shall attend.
- B. Health and Safety Meetings. The Contractor shall conduct health and safety meetings for their personnel and subcontractors as set forth in their CHASP (see Section 01065).
- C. Progress Meetings. The Lead PRP will schedule regular progress meetings at least on a weekly basis to review work progress, schedules, and other matters needing discussion and resolution.
1. The meetings will be held on site.
  2. The Contractor and all major subcontractors shall attend.

## **PART 2 — PRODUCTS**

(Not used.)

## **PART 3 — EXECUTION**

(Not used.)

[END OF SECTION]

## **SECTION 01400**

### **CONSTRUCTION QUALITY CONTROL AND QUALITY ASSURANCE**

#### **PART 1 — GENERAL**

##### **1.01 SECTION INCLUDES**

- A. This section describes the requirements for the Contractor's Construction Quality Control (CQC) activities. CQC refers to those actions taken by the Contractor, Manufacturers, or Suppliers, including their designated representatives, to ensure that the materials and the workmanship meet the requirements of the Final Design.
- B. This section also describes the Contractor's responsibilities with respect to Construction Quality Assurance (CQA). CQA refers to means and actions employed by the CQA personnel, to assure conformity of RD/RA construction with the requirements of the Final Design (i.e., Drawings, Specifications, and CQA Plan). CQA is provided by an independent third-party consultant (i.e., "CQA Consultant") that is contracted by the Lead PRP and independent from production and installation (i.e., independent of the Contractor and any material suppliers).

##### **1.02 RELATED SECTIONS AND PLANS**

- A. All Sections of the Specifications
- B. Construction Quality Assurance Plan (CQAP)

##### **1.03 SUBMITTALS**

- A. The Contractor shall prepare and submit a CQC Plan to the CQA Consultant at least 14 days prior to mobilization and start of the work.

##### **1.04 CQC PLAN**

- A. The CQC Plan shall provide the testing and documentation procedures to be performed by the Contractor necessary to ensure that the construction is performed in accordance with the Specifications.
- B. As a minimum, the plan shall contain a description of the quality control objectives for the construction work, a description of the Contractor's personnel organization and the responsibility of key individuals, as well as the QC procedures. Any forms referenced in the document should be included in an appendix to the plan.

C. The following subsections provide guidance for preparation of the CQC plan:

1. Introduction.
  - a. Include a general description of the work, focusing on the components addressed in the plan.
  - b. Describe the purpose and objectives of the CQC program.
2. Organization and Responsibilities. Include tables and charts showing the project organization lines of authority and communication matrix. Key individuals from the Contractor's organization and all subcontractors should be identified.
3. Quality Control Requirements. Describe the CQC protocols that will be required as parts of the work. The following topics should be addressed:
  - a. Independent Observations and Tests. Include a description of the individual or organization responsible for these activities.
  - b. Sampling Activities. Include a description of all sampling activities that will be performed. The individual or organization responsible for the collection of each type of sample should be identified.
  - c. Reporting Requirements. Provide a description of the CQC reporting requirements including frequency of reports and report format.
  - d. Corrective Action. Provide a description of the types of corrective actions which may be used.
4. Quality Control Procedures:
  - a. Describe the procedures that will be used for inspection, testing, and management of data. At a minimum, procedures should be provided for the evaluation of the following:
    - i. earthwork stripping, excavation, backfilling, and compaction operations;
    - ii. geosynthetic installation;
    - iii. waste excavation;
    - iv. gas collection system installation; and

- v. equipment and personnel decontamination facilities.
- b. For each of the above activities, the following types should be addressed:
  - i. standards;
  - ii. test procedures;
  - iii. documentation;
  - iv. corrective actions; and
  - v. responsible party.
- c. Describe the procedures that will be used to obtain approval for deviations to the Drawings, Specifications, equipment, or materials that may occur during the work.
- d. Describe the procedures that will be used for records management.

#### **1.05 CONTRACTOR'S RESPONSIBILITIES DURING CQA**

- A. The Contractor shall cooperate with the CQA Consultant and provide access to work.
- B. The Contractor shall secure and deliver to the CQA Consultant adequate quantities of representative samples of materials proposed to be used and which require testing.
- C. The Contractor shall furnish incidental labor and facilities as follows:
  - 1. To provide access to work to be tested.
  - 2. To obtain and handle samples at the site or at source of product to be tested.
  - 3. To facilitate inspections and tests.
- D. The Contractor shall be aware of the activities set forth in the CQAP and shall account for these activities in the construction schedule.
- E. The Contractor shall assist CQA personnel in every manner necessary for the proper performance of activities set forth in the CQAP.

- F. CQA testing or inspections performed by the CQA Consultant in no manner relieves the Contractor of the responsibility to construct all work to conform to the Drawings and Specifications.
- G. If quality control or quality assurance tests indicate the Work does not meet specified requirements, the Contractor shall remove the Work, replace and retest at no additional cost to the Lead PRP.

## **PART 2 — PRODUCTS**

(Not Used.)

## **PART 3 — EXECUTION**

(Not Used.)

[END OF SECTION]



## **SECTION 01500**

### **CONSTRUCTION FACILITIES AND TEMPORARY CONTROLS**

#### **PART 1 — GENERAL**

##### **1.01 SCOPE**

- A. This Section covers requirements for provision, maintenance, and removal of temporary on-site facilities necessary for proper conduct of the work. The Contractor shall furnish and maintain temporary facilities including but not limited to Contractor's field office, the CQA Consultants' field office, personnel decontamination facilities, temporary decontamination pad, Contractor's personnel shelters, telephone service, sanitary facilities, Contractor's storage facility, etc.

##### **1.02 RELATED SECTIONS**

- A. Section 01065 – Safety, Health, and Emergency Response Requirements
- B. Section 01032 – Environmental Protection

##### **1.03 FIELD OFFICES**

- A. The Contractor shall provide and maintain an on-site field office for use by the Contractor and their subcontractor personnel.
- B. The Contractor shall provide a field office for the CQA Consultant which shall be of sufficient size to allow four (4) persons to work comfortably including the Lead PRP's Project Coordinator and IEPA representative.
- C. Field office shall be furnished by Contractor as follows:
  - 1. At the Contractor's option, a portable or mobile building may be used as a field office. A mobile home, if used, shall be modified for office use.
  - 2. The office shall have sufficient floor space to provide for desks, lockable file cabinets for records storage, other storage cabinets, and other furnishings as needed.
  - 3. The Contractor shall provide office furniture (e.g., desks, chairs, files, tables, etc.) as needed.
  - 4. The office shall be weathertight, insulated, and structurally sound. OSHA-approved steps and landings shall be provided at all doors.
  - 5. Open parking space next to the field office for Contractor's vehicles and a temporary access road shall be provided by the Contractor.

6. Water, electricity, air conditioning and telephone (4 lines) service shall be provided by the Contractor.
7. The Contractor shall pay all utility installation, connection and removal charges, and all bills for the duration of the contract.
8. The Contractor's office shall be equipped with a photocopying machine and related supplies, and shall be made available for use by the CQA Consultant.
9. Entrance doors shall be equipped with locks.

#### **1.04 TEMPORARY UTILITIES**

- A. The Contractor shall avoid excavation for utility installation within the site boundaries. Utilities shall be run at grade or overhead.
- B. Electric Power:
  1. Contractor shall determine the type and amount available and make arrangements for obtaining temporary electric power service, and metering equipment.
  2. Temporary electric power installations shall meet construction safety requirements of OSHA, state, local, National Electric Code (NFPA 70), and other governing agencies.
- C. Water:
  1. Contractor shall determine water source type and availability and make arrangements for obtaining water to meet their project requirements. Potable water shall be supplied by the Contractor for project personnel use. Water from Yeoman Creek shall not be obtained as a water source for dust control and soil moisture conditioning.
  2. Contractor shall provide necessary water required for the equipment, systems, or facilities to be used and required to complete the Work.
- D. Sewage:
  1. The Contractor shall provide and maintain sanitary facilities that comply with regulations of local and state health departments.
  2. The Contractor shall provide chemical toilets of suitable types and maintain them in a sanitary condition at all times, conforming to code requirements and acceptable to the health authorities. They shall be of watertight construction so that no contamination of the area can result from their use. Make arrangements for frequent emptying of toilets. Upon completion of the work, remove toilets and restore area to original condition.

E. Telephone:

1. The Contractor shall provide on-site telephone service for himself and subcontractors' use during construction.
2. The Contractor shall provide a separate on-site telephone service line for CQA Consultant's sole use during construction.

F. Internet

1. The Contractor shall provide high-speed internet for himself, his subcontractors, CQA Consultant and the Lead PRP during construction.

**1.05 PERSONNEL DECONTAMINATION FACILITY**

- A. The Contractor shall provide personnel decontamination facilities as needed to comply with the CHASP.

**1.06 TEMPORARY DECONTAMINATION PAD**

- A. The Contractor shall construct and maintain a temporary decontamination pad(s) near the site exit(s) for cleaning vehicles and equipment before they leave the site, as described in their CHASP.
- B. The Contractor can utilize the existing decontamination pad shown on the Drawings.

**1.07 PROJECT SIGNS**

- A. The Contractor shall provide all labor, equipment, and materials required to provide and erect three project identification signs prior to the start of construction.
- B. The project identification signs shall be erected at locations as directed by the Lead PRP's Project Manager. Lettering on the sign shall be professionally executed, straight, uniform, and evenly spaced. The sign shall be constructed of 3/4-inch medium density overlay plywood supported on 4 x 4 foot posts with adequate bracing to resist wind. The signs shall measure at least 5 ft wide and 4 ft tall, and the bottom of the sign shall be at least 4 ft off the ground. The signs shall be painted with at least two coats of exterior paint of a type formulated for use on exterior signs.
- C. No sign or advertisement, except the project identifications signs, shall be allowed to be displayed without the Lead PRP's approval.

## **1.08 TEMPORARY FENCING**

- A. The Contractor shall install a temporary fencing around the perimeter of the borrow pit area. The Contractor shall submit product and installation details to the CQA Consultant.

## **1.09 SUBMITTALS**

- A. The Contractor shall submit product and installation details for the temporary fencing to the CQA Consultant 14 days prior to installation.

## **PART 2 — PRODUCTS**

### **2.01 FACILITIES, TRAILERS, FURNISHINGS**

- A. The facilities, trailers, and furnishings may be new or used but shall be serviceable and adequate for the required purpose. The facilities, trailers, and furnishings shall meet applicable codes and regulations and shall not create unsafe or unsightly conditions. Service connections shall be made in accordance with all local and national electric codes.

## **PART 3 — EXECUTION**

### **3.01 PREPARATION**

- A. The Contractor shall grade the sites of the temporary facilities to promote drainage.

### **3.02 INSTALLATION**

- A. The Contractor shall construct the field offices, personnel decontamination facilities, personnel shelter, storage shelter, etc. at their approved locations. The facilities shall be constructed on structurally suitable foundations. Trailer units shall be jacked off the wheels, supported on a temporary foundation, and grounded. Steps and landings shall be provided at all doors.
- B. The Contractor shall provide vehicular access and parking space at the field office. Access roadways and parking areas shall be graded with crushed stone.
- C. The Contractor shall install furnishings and equipment and provide utility service.

- D. The Contractor shall install a temporary fencing around the perimeter of the borrow pit to prevent access to work area during construction. The temporary fencing shall connect to the existing landfill site fence.

### **3.03 MAINTENANCE AND SERVICE**

- A. The Contractor shall:
  - 1. provide continuous maintenance during the construction period;
  - 2. provide utilities and pay the cost thereof;
  - 3. provide janitorial service at least once per week and as otherwise needed;
  - 4. repair or replace damaged items as necessary; and
  - 5. include the offices within overall site security measures.

### **3.04 PROTECTION AGAINST THEFT, DAMAGE, AND WEATHER**

- A. Site security during construction is the sole responsibility of the Contractor. Stolen, damaged, vandalized, missing equipment or material or weather damage will be considered the property of the Contractor, and the risk of loss of such materials, equipment, or cost of labor to install such, shall remain with the Contractor until final acceptance by the Lead PRP.

### **3.05 REMOVAL**

- A. The facilities described in this section shall remain the property of the Contractor.
- B. The facilities described in this section shall be removed from the site within thirty (30) days of receipt of notice to remove, or as otherwise required by the Lead PRP.

[END OF SECTION]

## **SECTION 01700**

### **PROJECT RECORD DOCUMENTS AND PROJECT CLOSEOUT**

#### **PART 1 — GENERAL**

##### **1.01 SCOPE**

- A. This Section covers the requirements for maintenance and submittal of Project Record Documents, and other project closeout procedures.

##### **1.02 MAINTENANCE OF PROJECT RECORD DOCUMENTS**

- A. Throughout the work the Contractor shall maintain in a safe place at the site one record copy of project documents including:
  - 1. Drawings;
  - 2. Specifications;
  - 3. Written Plans (e.g., CHASP, etc.)
  - 4. CQAP;
  - 5. Contract Documents;
  - 6. Subcontracts;
  - 7. Change orders, field orders, and other modifications to the Contract;
  - 8. Daily work activity summary reports;
  - 9. Construction Photographs;
  - 10. Approved shop drawings;
  - 11. Product data and samples;
  - 12. As-built documentation;
  - 13. Other approved documents submitted by the Contractor in compliance with these Specifications; and

14. Documentation related to performance of the work.

B. Additions:

1. The Contractor shall legibly mark each item on the Project Record Documents and Shop Drawings to record actual construction, including:
2. Field changes of dimension and detail;
  - a. Significant changes made during the construction process, including changes in field dimensions, details, etc.; and
  - b. Significant detail not shown in the original Contract Documents.
3. The Contractor shall keep Project Record Documents current.
4. The Project Record Documents shall be kept on the job site, amended as changes occur, and returned to the Lead PRP with claim for final Application for Payment.

C. The Contractor shall store Project Record Documents separate from documents used for construction.

### **1.03 PROJECT CLOSEOUT PROCEDURES**

- A. The Contractor shall submit written certification that the Contract Documents have been reviewed, the Work has been inspected, and that the Work is complete in accordance with Contract Documents and ready for the Lead PRP's and IEPA's final inspection.
- B. At the completion of field operations, the Contractor shall deliver Project Record Documents to the Lead PRP. Delivery shall be accompanied with a transmittal letter, indicating the date, project title and number, the Contractor's name and address, and the title of each Project Record Document. Along with the record documents listed in this section, the Contractor shall provide as-built documentation, all submittals required by these Specifications, and any other submittals required by governing or other authorities to the Lead PRP.
- C. The Contractor shall submit final application for Payment identifying total adjusted Contract Sum, previous payments, and sum remaining due.

#### **1.04 FINAL CLEANING**

- A. Upon completion of the Work and prior to final inspection, the Contractor shall remove all of its equipment, signs, facilities, construction materials, and trash, and shall perform any other reasonable clean-up activities requested by the Lead PRP. All disturbed areas shall be revegetated or otherwise put into a condition satisfactory to the Lead PRP.

#### **PART 2 — PRODUCTS**

(Not used.)

#### **PART 3 — EXECUTION**

(Not used)

[END OF SECTION]



## **DIVISION 2 – SITE WORK**

### **SECTION 02100**

#### **SURVEYING**

##### **PART 1 – GENERAL**

###### **1.01 SCOPE**

- A. The work of this Section shall include, but not necessarily be limited to: providing pre-construction topographic survey, establishing survey control points, providing survey control and layout during construction, verifying thickness of constructed layers, delineating extent of construction areas, providing survey information for the calculation of installed material quantities, and generating final as-built documentation and drawings.

###### **1.02 RELATED SECTIONS**

- A. All Sections of Specifications.

###### **1.03 QUALIFICATION OF SURVEYOR**

- A. The Contractor shall retain the services of an independent registered Land Surveyor licensed in the State of Illinois.
- B. The Surveyor shall have a proven record of successful performance on projects of similar magnitude.
- C. The term “Surveyor” as used throughout these Specifications shall apply to the Contractor’s Surveyor. The term “CQA Surveyor” shall apply to the surveying firm contracted by the CQA Consultant or the Lead PRP and as described further in the Construction Quality Assurance Plan (CQAP).

###### **1.04 SUBMITTALS**

- A. The Contractor shall provide the following submittals at least 14 days prior to survey activities:
  - 1. the name, address and telephone number of the Surveyor;
  - 2. the Surveyor’s qualifications;
  - 3. a summary of the project staffing, scheduling, and the type of equipment the Surveyor intends to use in the field and in the office (i.e., computer software) to complete the project.

- B. Upon request of the CQA Consultant, documentation shall be submitted in order to verify the accuracy of the survey work.
- C. Provide survey of the re-delineated wetland boundary 14 days prior to construction activities. See Article 1.04 of Section 01032 for more information.
- D. Acceptance letter for the existing conditions or provide pre-construction survey results to the CQA Consultant 14 days prior to work.
- E. Provide as-built survey to the CQA Consultant within 30 days of construction completion.

#### **1.05 SURVEY REQUIREMENTS**

- A. The Surveyor shall provide survey control for each stage of construction, and “as-built” documentation for various components of construction. The Surveyor shall furnish all labor, materials, tools, supervision, transportation, and equipment necessary to perform the project surveying work as specified herein for the final cover system, access roads, and other structures, as shown on the Drawings.
- B. The Surveyor shall locate construction control points prior to starting site work. The Contractor or the Surveyor shall promptly notify the CQA Consultant in writing of any discrepancies discovered before or during construction and inform the Lead PRP of actions taken.
- C. The Contractor shall protect each permanent survey control point during construction. The Surveyor shall immediately replace any survey control point which is lost, destroyed, or requires relocation, and at no additional cost to the Lead PRP.
- D. The Surveyor shall maintain lines and levels, layout, and locate the work utilizing recognized engineering survey practices. A complete and accurate log of control and survey work must be maintained.
- E. The survey instruments used on this project shall be capable of reading to a precision of 0.01 ft and with a setting accuracy of 10 seconds.
- F. Surveying activities shall meet or exceed the Minimum Standards of Practice for Land Surveying in the State of Illinois, as adopted by the Illinois Professional Land Surveying Association (IPLSA).

## **1.06 CONSTRUCTION TOLERANCES**

- A. Construction tolerances shall be as specified in the various Sections of these Specifications, and as given below.
- B. The construction tolerances on final grades shall be within plus or minus two tenths (0.20) of a foot. Surveying tolerances on slopes shall be within plus or minus ten percent (10%) of the specified slope as calculated from the highest point of the slope (e.g., for a 3 horizontal:1 vertical or 33.3 percent slope, the finished surface shall have a slope which measures between 30 percent and 36.6 percent between any spot and the top of the overall slope). Additionally, drainage features (e.g., ditches, pipes, culverts, etc.) shall maintain positive drainage and shall drain in the direction shown on the drawings.
- C. The Surveyor shall cooperate fully with the Lead PRP and CQA personnel at all times.

## **PART 2 – PRODUCTS**

(not used)

## **PART 3 - EXECUTION**

### **3.01 SURVEY CONTROL**

- A. The Contractor shall survey and establish any additional survey control required for performance of the Work, conduct all measurements, and check all dimensions necessary for proper execution of the Work. The Contractor shall be responsible to re-establish existing survey control lost during the course of work. New survey control established by the Contractor shall be tied into the existing survey control shown on the Drawings.
  - 1. Survey control shall be set and measurements taken using standard accepted surveying methods and equipment.
  - 2. Surveyor's field notes shall be included with Project Record Documents (Section 01700) for submittal to the CQA Consultant. The professional engineer's and/or registered surveyor's signatures shall be included on all field notes and surveyed as-built documents.
  - 3. Surveying instruments shall be calibrated prior to the start of the work.

### **3.02 PRE-CONSTRUCTION SURVEY**

- A. The Contractor shall check and accept the existing conditions prior to start of construction. The Contractor shall submit a letter to the CQA Consultant accepting the existing conditions as shown on the Drawings.
- B. If the Contractor elects to perform his own existing conditions survey, the Surveyor shall perform a detailed pre-construction site survey to establish existing grade levels, locations and elevations of all site features and boundaries prior to initiating work at the site. The topographic data shall be obtained on a grid system which shall not exceed 50 feet in the north-south or east-west directions. The pre-construction site survey shall also include changes in slope grades (e.g., toe and crest of slope, slope changes, etc.), alignments of existing site drainage features, and other existing structures or prominent features at the site. The pre-construction site topographic information shall extend a minimum of 100 feet in all directions beyond the limits of disturbance shown on the Drawings.

### **3.03 AS-BUILT DOCUMENTATION**

- A. The Surveyor shall provide, at a minimum, a detailed as-built survey and drawings for the following components:
  - 1. Bottom of sediment excavation and top of restored (backfilled) sediment excavation areas.
  - 2. Top of Clay Fill.
  - 3. Top of Vegetative Soil Layer.
  - 4. Alignment of leachate trenches, Stormwater structures, locations of storage tanks and gas collection system components.
  - 5. Post-construction topographic survey of the entire landfill extending a minimum of 100 feet in all directions beyond the limits of disturbance shown on the Drawings.
- B. The above listed as-built components shall be surveyed at a minimum on each construction control point shown on the Drawings and at other grade breaks (i.e., crest of slope, toe of slope, drainage path, etc.), so that accurate and representative contour maps may be generated from the survey readings. Alignments shall be surveyed at 100-ft intervals and at changes in direction.
- C. The as-built Drawings shall show contours generated by the survey points and identify each control point coordinates and elevation in an accompanying table. The as-built drawings shall be prepared using computer aided drafting (CAD) software and shall be at the same scale, coordinate system, and contour interval as the corresponding plan

drawing presented in the Final Design unless otherwise directed by the CQA Consultant.

All as-built drawings shall show grid lines corresponding to those shown on the Drawings and shall conform to industry standards as to quality and information shown. As-built drawings shall be labeled with the name of the project, the name of the Surveyor, the date of the survey, and the survey location and purpose.

- D. The detailed post-construction topographic survey shall be performed immediately after completion of construction and shall extend a minimum of 100 ft in all directions beyond the limits of disturbance. The topographic data shall be obtained on a grid system which shall not exceed 50 feet in the north-south or east-west directions.
- E. Procedures for submitting as-builts and review by the CQA Consultant: The Surveyor shall be prepared to provide the CQA Consultant with as-built survey readings in tabular or electronic format immediately upon request. The final as-built drawing for a given project component shall be submitted to the CQA Consultant within 30 days of completion of that component. The CQA Consultant's review process for as-built information will be in accordance with the submittal procedures prescribed in Section 01300 and as set forth in the Contract Documents.
- F. Number of copies required: 2 copies of the final as-built drawings shall be provided to the CQA Consultant.

### **3.04 PROFESSIONAL STAMP**

- A. All as-built survey drawings shall bear the stamp and signature of the Professional Land Surveyor registered in the State of Illinois and responsible for the survey work.

[END OF SECTION]

## **SECTION 02105**

### **EROSION AND SEDIMENT CONTROL**

#### **PART 1 – GENERAL**

##### **1.01 SCOPE**

- A. The Contractor shall furnish all labor, materials, tools, supervision, transportation, installation equipment, and incidentals required to install and maintain all erosion and sediment control measures and structures including, but not limited to silt fence, straw wattles, check dams, sediment traps, dewatering pumping, and sediment basins throughout the duration of the project and removal of temporary measures and structures, and restoration of disturbed areas.

##### **1.02 RELATED SECTIONS**

- A. Section 01032 – Environmental Protection
- B. Section 01060 – Regulatory Compliance
- C. Section 02110 – Clearing, Grubbing, and Stripping
- D. Section 02200 – Earthwork
- E. Section 02300 – Leachate and Gas Collection System

##### **1.03 REFERENCES**

- A. Boone County Subdivision Regulations, Sections 508 and 510, as part of the Boone County Code, enacted 19 March 2014.
- B. Illinois Department of Transportation Standard and Supplemental Specifications for Road and Bridge Construction, latest edition.
- C. Illinois Urban Manual (Technical Manual Designed for Urban Ecosystem Protection and Enhancement, USDA Natural Resources Conservation Service (NRCS) for Illinois).
- D. Construction Management Plan (to be prepared by Contractor).
- E. Construction Operations Plan (to be prepared by Contractor).
- F. Construction Quality Assurance Plan (CQAP).

- G. Construction Health and Safety Plan/Contingency Plan (to be prepared by Contractor).
- H. ASTM C 31 – Standard Practice for Making and Curing Concrete Test Specimens in the Field.
- I. ASTM C 39 – Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.
- J. ASTM C 231 – Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.

#### **1.04 SUBMITTALS**

At least 14 days prior to the start of installation of the erosion and sediment control measures, the Contractor shall submit the following information to the CQA Consultant:

- A. Schedule for the implementation of SESC measures.
- B. Manufacturer's product data and recommended methods of application for silt fence.
- C. Manufacturer's product data and recommended methods of application for straw wattles.
- D. Manufacturer's product data for geotextiles.
- E. Manufacturer's product data and recommended methods of application for erosion control blanket (ECB).
- F. For on-site and off-site sources of the Vegetative Soil Layer, submit a sample to a local soil conservation service or horticulture laboratory for a soil analysis for organic content, acidity, available nutrients (phosphorous, potassium, nitrogen, etc.) and recommendations on fertilizer type, application rate, etc. needed to establish a good stand of vegetation. Results of the analysis and recommendations shall be submitted to the CQA Consultant.
- G. Proposed seed mix(es), mulch and fertilizer.
- H. Manufacturer's product data and recommended methods of application for seed, mulches, and fertilizer.
- I. Manufacturer's certificate of compliance for each seed mix. These certificates shall include the seed mixture, guaranteed percentages of purity, weed content, germination

of the seed, name of the seller, the test date for the seed, and the net weight and date of shipment.

- J. Manufacturer's recommendations for on-site storage of all erosion and sediment control features.
- K. A written certification signed by a responsible party employed by the erosion control blanket Manufacturer that the materials assigned and delivered meet or exceed the specified properties for that type of erosion control blanket.
- L. Copies of load tickets, shipping manifests that describe the product, quantity, provider, the date of shipment shall be provided to the CQA Consultant on a daily basis.
- M. The Contractor shall notify the CQA Consultant a minimum of 14 days prior to starting seeding activities.

#### **1.05 COMPLIANCE WITH REGULATIONS**

- A. It is the sole responsibility of the Contractor to be completely familiar with and to follow all local, state, and federal regulations pertaining to Work required in this Section.

#### **1.06 HEALTH AND SAFETY**

- A. The Contractor shall follow all procedures set forth in their Construction Health and Safety Plan/Contingency Plan.
- B. Any deviations from the Construction Health and Safety Plan/Contingency Plan must be submitted to the CQA Consultant in writing prior to being implemented.

#### **1.07 CONSTRUCTION QUALITY ASSURANCE**

- A. Construction of the erosion and sediment control components of the project shall be monitored by the CQA Consultant as outlined in the CQAP.
- B. The Contractor shall be aware of the activities set forth in the CQAP and shall account for these activities in the construction schedule.
- C. The Contractor shall assist CQA personnel in every manner necessary for the proper performance of activities set forth in the CQAP.
- D. CQA testing or inspections performed by the CQA Consultant in no manner relieves the Contractor of the responsibility to construct all work to conform to the Drawings and



Specifications.

- E. If quality control or quality assurance tests indicate Work does not meet specified requirements, the Contractor shall remove Work, replace and retest at no additional cost to the Lead PRP.

## **1.08 EXISTING CONDITIONS**

- A. The Contractor shall immediately notify the Lead PRP and the CQA Consultant if other utility lines or structures, not shown on the Drawings, are encountered. Repair of damage and all restitution for liabilities resulting from damage to existing facilities due to activities by the Contractor shall be at the Contractor's expense. The Contractor shall comply with applicable regulations in locating and providing clearance for all underground and above ground utilities prior to beginning construction activities.

## **PART 2 – PRODUCTS**

### **2.01 SILT FENCE**

- A. Silt fence shall be pre-assembled and shall meet the requirements of the Illinois Urban Manual as shown on the Drawings.

### **2.02 STRAW WATTLE**

- A. Straw wattles shall be fresh agricultural straw and shall meet the requirements shown on the Drawings.

### **2.03 TEMPORARY SEEDING**

- A. Temporary seeding shall consist of seed mixes shown in Table 02105-1. The seed mix shall be free of weeds or other noncomplying material.

### **2.04 PERMANENT SEEDING**

- A. Permanent seeding shall consist of seed mixes shown in Table 02105-2 and Table 02105-3. The seed mix shall be free of weeds or other noncomplying material.

### **2.05 FERTILIZER**

- A. Fertilizer shall be dry or liquid commercial grade fertilizer uniform in composition that meets the requirements of all State and Federal regulations and standards of the Association of Agricultural Chemists. Fertilizer shall be delivered to the site in original,

properly labeled, unopened, clean, containers each showing the manufacturer's guaranteed analysis conforming to applicable fertilizer regulations and standards. Fertilizer composition shall be as recommended by the results of the soil analysis described in 1.04(E).

## **2.06 EROSION CONTROL BLANKET**

- A. Erosion control blankets shall be Tensar North American Green SC150BN or SC250 as shown on the Drawings. The Contractor may propose equivalent blankets.

## **2.07 VEGETATIVE SOIL LAYER**

- A. Vegetative Soil Layer shall conform to the requirement provided in Section 02200 of the Specifications.

## **2.08 RIPRAP**

- A. Riprap shall be IDOT RR-3 or RR-4 as specified in the Drawings.

## **2.09 SEPARATOR FABRIC**

- A. Separator Fabric shall meet the requirements set forth in Section 02200 of the Specifications.

## **2.10 MULCH**

- A. Straw mulch shall come from oats, wheat, rye or barley and be free of diseased plant residue, weed seeds, and harmful chemical residues. Hydraulic mulch shall consist of wood, cotton, straw, or paper – or a combination of the four.

## **2.11 FABRIC-FORMED CONCRETE**

- A. Fabric-Formed Concrete shall be an average 6-inch thick filter-point style mat (characterized by approximate 10-inch filter-point spacing) composed of cast-in-place fine aggregate concrete (grout) formed using a specially woven, double layer, open selvage fabric joined in a mat configuration.
- B. Each fabric layer shall consist of uncoated nylon synthetic yarns with sufficient grab tensile strength and porosity to withstand the pressure of the grout injection pump without breaking the layers of fabric. The nylon yarns shall also provide a relatively high resistance to ultraviolet light and alkali degradation.

- C. Each fabric layer shall have a minimum weight per ASTM D 5261 of 12 oz/yd (403 g/m) and a minimum AOS per ASTM D 4751 of U.S. Standard Sieve Size 40 (0.425mm).
- D. Each fabric layer shall exhibit a minimum grab tensile strength of 200 lbs (900N) in both warp and fill directions when tested according to ASTM D 4632, Grab Tests, Method 16, using a 4 x 8 in. sample, 3 in. gage length, clamped in a 1 in. wide by 2 in. long grip, tested at a strain rate of 12 in/min in a CRE testing machine. The fabric shall be tested wet.
- E. Fine aggregate concrete (grout) shall consist of a mixture of Portland cement, fine aggregate and water proportioned and mixed to provide a flowable grout. Use of admixtures must be approved by the Engineer. The grout shall have an air content of not less than 5% and not more than 9% as measured in accordance with ASTM C-231. The hardened concrete grout shall exhibit a minimum compressive strength of 2,500 psi at 28-days. Samples shall be prepared in accordance with ASTM C-31 and tested in accordance with ASTM C-39. Air content and unconfined compressive strength testing shall be performed by the Contractor and test results shall be provided to the CQA Consultant. Four cylinders shall be obtained from every 50 yd<sup>3</sup> of mix. Two of the samples shall be tested for unconfined strength at 7 days and the other two samples shall be tested at 28 days. Air content testing shall be performed for every truck load of concrete delivered to the site.

## **PART 3 – EXECUTION**

### **3.01 FAMILIARIZATION**

- A. Prior to implementing any of the work described in this Section, the Contractor shall become thoroughly familiar with the site, the site conditions, and all portions of Work within this Section.
- B. Prior to implementing any of the work in this Section, the Contractor shall carefully inspect the installed Work of all other Sections and verify that all work is complete to the point where the installation of this Section may properly commence without adverse impact.

### **3.02 INSTALLATION OF EROSION AND SEDIMENT CONTROL MEASURES, AND APPLICATION OF SEED MIXES**

- A. Standard details and requirements representing the minimum erosion and sediment control standards that shall be met by the Contractor during construction are provided on the

Drawings and in this Section. However, regardless of any minimum standards, the Contractor is solely responsible for selecting, implementing, and maintaining proper and fully adequate erosion and sediment controls at all times.

- B. Silt fence shall be installed in accordance with the requirements given in the Illinois Urban Manual and as shown on the Drawings.
- C. Straw wattles shall be installed in accordance with the manufacturer's specifications and as shown on the Drawings. The Contractor is responsible to remove the straw wattles and stakes after vegetation is established as determined by the CQA Consultant.
- D. Temporary seeding shall be applied, within 7 days, by the Contractor to disturbed areas that will be idle for greater than 14 days. Areas where temporary seeding has been applied shall be protected through the application of mulch.
- E. Permanent seeding shall be applied to disturbed areas within 7 days of when final grades are achieved. The Storm Water Seed Mix (Table 02105-3) shall be applied with in the storm water basins, including on the side slopes of the basins. All other on-site areas shall be permanently seeded with the Cover Seed Mix (Table 02105-2). Areas where permanent seeding has been applied shall be protected through the application of mulch or installation of erosion control blankets as shown on the Drawings.
- F. For hydroseeding, seed shall be put in the mixture slowly to result in a uniform mixture before application. Hydroseeding mixtures shall be constantly agitated from the time of mixing until application on the seed bed and used within 8 hours from the beginning of mixing.
- G. Mulch shall be installed in accordance with the requirements given in the Illinois Urban Manual and as shown on the Drawings. Straw mulch shall be applied at a rate of two (2) tons per acre. The straw mulch shall be stabilized using one of the following methods:
  - 1. Anchoring by means of mechanical stabilizer, or crimper, with dull, flat, parallel disks spaced approximately eight inches apart. Mulch material shall be tucked 2" to 3" into the soil surface.
  - 2. Stabilizing by the application of an overspray of hydraulic mulch after the application of straw mulch. The hydraulic mulch shall be applied by a hydraulic mulcher at a minimum rate of 900 lb. of mulch per acre. The hydraulic mulch shall be mixed in accordance with manufacturer's recommendations. Hydraulic mulch shall not be applied when the ambient temperature is at or below freezing.

3. Anchoring by means of stabilizing the mulch with a chemical mulch binder applied with the straw or as an overspray. Chemical mulch binder shall be approved as safe for the surrounding ecosystem.

Hydraulic mulch shall be installed using a hydraulic mulcher. The mulch shall be applied at a rate of one (1) ton of mulch per acre. The hydraulic mulch shall be mixed in accordance with manufacturer's recommendations. Hydraulic mulch shall not be applied when the ambient temperature is at or below freezing.

- H. Erosion control blanket (ECB) shall be installed in accordance with the manufacturer's specifications, as shown on the Drawings, and in the following manner:
  1. ECB shall be installed within 48 hours after seeding, fertilizing, and mulching operations have been completed in the work areas.
  2. The ECB shall be placed on a smooth surface which is free of vegetation, trash, ruts, and rocks.
  3. Erosion mat shall be placed flat, in firm contact with the soil and conforming to the contours of the soil surface.
- I. Standard details and requirements representing the minimum erosion and sediment control standards that shall be met by the Contractor during construction are provided on the Drawings. However, regardless of any minimum standards, the Contractor is solely responsible for selecting, implementing, and maintaining proper and fully adequate erosion and sediment controls at all times.

### **3.03 SURVEYING AND CONSTRUCTION TOLERANCES**

- A. All surveying shall be performed in accordance with Section 02100.

### **3.04 PROTECTION OF WORK**

- A. The Contractor shall use all means necessary to protect all prior Work, including materials and completed Work of other Sections.
- B. The Contractor shall inspect erosion and sediment controls after rainfall events.
- C. In the event of damage, the Contractor shall immediately make all repairs and replacements necessary, at no additional cost to the Lead PRP.

### **3.05 ACCEPTANCE**

- A. The vegetated areas shall be accepted at the end of the warranty period specified in Paragraph 3.06A of this Section if a satisfactory condition as defined in this Section exists.
- B. A satisfactory condition of seeded area is defined as a 10,000 square feet section of turf that has no bare spots larger than three square feet and not more than 15 percent of the total area with bare spots larger than 6-inches square.

### **3.06 WARRANTY PERIOD**

- A. Vegetated area shall be subject to a warranty period of not less than two (2) full growing seasons from initial establishment of permanent seeding over 100 percent of the areas seeded.
- B. At the end of the first and second years of the warranty period, the CQA Consultant will perform an inspection upon written request by the Contractor. Vegetated areas not demonstrating satisfactory condition of vegetation as outlined above, shall be repaired, reseeded, and maintained to meet all requirements as specified herein at the Contractor's expense.
- C. After all necessary corrective work has been completed and permanent vegetation is established, the CQA Consultant will certify in writing the final acceptance of the seeded areas.

**TABLE 02105-1**

**TEMPORARY SEEDING SPECIES, RATES AND DATES<sup>1</sup>**

<b>Species</b>	<b>Pounds/Acre</b>	<b>Seeding Dates</b>
Oats	90	Early spring – July 1
Cereal Rye	90	Early spring – Sept. 30
Wheat	90	Early spring – Sept. 30
Perennial Ryegrass	25	Early spring – Sept. 30

<sup>1</sup> Applying the Cover Seed Mix outside of the periods provided in the table shall be based on recommendations (e.g. dormant seeding rates) of the seed supplier and as approved by the Engineer.

**TABLE 02105-2**

**PERMANENT SEEDING—COVER SEED MIX<sup>1</sup>**

<b>Species</b>	<b>Pounds/Acre</b>	<b>%</b>
Kentucky 31 Tall Fescue	122	43
Hard Fescue	120	41
Annual Rye Grass	46	16
<b>Total</b>	<b>288</b>	<b>100</b>

<sup>1</sup> Seeding dates for the Cover Seed Mix are April 1<sup>st</sup> to June 1<sup>st</sup> and August 15<sup>th</sup> to September 30. Applying the Cover Seed Mix outside of these periods shall be based on recommendations (e.g. dormant seeding rates) of the seed supplier and as approved by the Engineer.



**TABLE 02105-3**

**PERMANENT SEEDING—STORM WATER POND SEED MIX<sup>1</sup>**

<b>Botanical Name</b>	<b>Common Name</b>	<b>PLS Ounces/Acre</b>
<b>Permanent Grasses/Sedges/Rushes:</b>		
<i>Carex crisatella</i>	Crested Oval Sedge	1.00
<i>Carex lurida</i>	Bottlebrush Sedge	2.00
<i>Carex vulpinoidea</i>	Brown Fox Sedge	6.00
<i>Elymus virginicus</i>	Virginia Wild Rye	12.00
<i>Glyceria striata</i>	Fowl Manna Grass	1.25
<i>Juncus effusus</i>	Common Rush	1.00
<i>Juncus torreyi</i>	Torrey's Rush	0.25
<i>Leersia oryzoides</i>	Rice Cut Grass	1.00
<i>Panicum virgatum</i>	Switch Grass	8.00
<i>Scirpus atrovirens</i>	Dark Green Rush	1.00
<i>Scirpus cypernus</i>	Wool Grass	0.50
<i>Scirpus fluviatilis</i>	River Bulrush	0.25
<i>Scirpus validus</i>	Great Bulrush	6.00
	<b>Total</b>	<b>40.25</b>
<b>Temporary Cover:</b>		
<i>Avena sativa</i>	Common Oat	360.00
<i>Lolium multiflorum</i>	Annual Rye	100.00
	<b>Total</b>	<b>460.00</b>
<b>Forbs &amp; Shrubs:</b>		
<i>Alisma spp.</i>	Water Plantain (Various Mix)	4.25
<i>Asclepias incarnata</i>	Swamp Milkweed	1.50
<i>Bidens spp.</i>	Bidens (Various Mix)	2.00
<i>Helenium autumnale</i>	Sneezeweed	2.00
<i>Lycopus americanus</i>	Common Water Horehound	0.25
<i>Mimulus ringens</i>	Monkey Flower	1.00
<i>Penthorum sedoides</i>	Ditch Stonecrop	0.50
<i>Polygonum pensylvanicum</i>	Pinkweed	4.00
<i>Rudbeckia subtomentosa</i>	Sweet Black-Eyed Susan	1.00
<i>Sagittaria latifolia</i>	Common Arrowhead	1.00
<i>Senna hebecarpa</i>	Wild Senna	1.00
<i>Thalictrum dasycarpum</i>	Purple Meadow Rue	2.00
	<b>Total</b>	<b>20.50</b>

<sup>1</sup> Seeding dates for the Storm Water Pond Seed Mix are between October 1st and June 15<sup>th</sup>. Applying the Storm Water Seed Mix beyond these dates shall be based on recommendations (e.g. dormant seeding rates) of the seed supplier and as approved by the Engineer.

[END OF SECTION]

**SECTION 02110**  
**CLEARING, GRUBBING, AND STRIPPING**

**PART 1 – GENERAL**

**1.01 SCOPE**

- A. This Section describes the requirements for clearing, grubbing, and stripping activities. The work shall include, but not be limited to:
  - 1. clearing and grubbing vegetated surfaces;
  - 2. shredding, chipping, or otherwise reducing the size of large trees, stumps, and bushes;
  - 3. transportation and disposal of all cleared, shredded, chipped material;
  - 4. stripping and stockpiling topsoil as indicated on the Drawings; and
  - 5. stripping and stockpiling existing clayey cover soil as indicated on the Drawings.

**1.02 RELATED SECTIONS**

- A. Section 01065 – Safety, Health, and Emergency Response Requirements
- B. Section 02100 – Surveying
- C. Section 02105 – Erosion and Sediment Control
- D. Section 02200 – Earthwork

**1.03 REFERENCES**

- A. Construction Management Plan (to be prepared by Contractor)
- B. Construction Operations Plan (to be prepared by Contractor)
- C. Construction Quality Assurance Plan (CQAP)
- D. Construction Health and Safety Plan/Contingency Plan (to be prepared by Contractor)

#### **1.04 COMPLIANCE WITH REGULATIONS**

- A. It is the sole responsibility of the Contractor to be completely familiar with and to follow all local, state, and federal regulations pertaining to Work required in this Section.

#### **1.05 HEALTH AND SAFETY**

- A. The Contractor shall follow all procedures set forth in their Construction Health and Safety Plan/Contingency Plan.
- B. Any deviations from the Construction Health and Safety Plan/Contingency Plan must be submitted to the Engineer in writing prior to being implemented.

#### **1.06 CONSTRUCTION QUALITY ASSURANCE**

- A. Clearing, grubbing, and stripping shall be monitored by the CQA Consultant as outlined in the CQAP.
- B. The Contractor shall be aware of the activities set forth in the CQAP and shall account for these activities in the construction schedule.
- C. The Contractor shall assist CQA personnel in every manner necessary for the proper performance of activities set forth in the CQAP.
- D. CQA testing or inspections performed by the CQA Consultant in no manner relieves the Contractor of the responsibility to construct all Work to conform to the Drawings and Specifications.
- E. If quality control or quality assurance tests indicate Work does not meet specified requirements, the Contractor shall remove Work, replace and retest at no additional cost to the Lead PRP.

#### **1.07 EXISTING CONDITIONS**

- A. The Contractor shall comply with applicable regulations in locating and providing clearance for all underground and above ground utilities prior to beginning construction activities. The Contractor shall immediately notify the Lead PRP and the CQA Consultant if other utility lines or structures, not shown on the Drawings, are encountered. Repair of

damage and all restitution for liabilities resulting from damage to existing facilities due to activities by the Contractor shall be at the Contractor's expense.

## **PART 2 – PRODUCTS**

### **2.01 MATERIALS**

- A. Materials to be cleared include trees, shrubs, and any debris or other foreign matter that exists over the existing topsoil.
- B. Existing topsoil shall be the surficial soil material not containing waste, debris, or other foreign matter, to a depth of 6 inches beneath the ground surface immediately after grubbing is complete.

## **PART 3 – EXECUTION**

### **3.01 FAMILIARIZATION**

- A. Prior to implementing any of Work described in this Section, the Contractor shall become thoroughly familiar with the site, the site conditions, and all portions of Work within this Section.
- B. Inspection: Prior to implementing any of Work in this Section, the Contractor shall carefully inspect the installed Work of all other Sections and verify that all Work is complete to the point where Work of this Section may properly commence without adverse impact.

### **3.02 EROSION AND SEDIMENT CONTROL**

- A. Prior to implementing any of Work described in this Section, the Contractor shall install all erosion and sediment controls in the relevant area(s) of construction.
- B. Standard details and requirements representing the minimum erosion and sediment control standards that shall be met by the Contractor during construction are provided on the Drawings and in Section 02105 of the Specifications. However, regardless of any minimum standards, the Contractor is solely responsible for selecting, implementing, and maintaining proper and fully adequate erosion and sediment controls at all times.

### **3.03 CLEARING AND GRUBBING**

- A. Clearing and grubbing shall only be performed in areas identified on the Drawings. All erosion and sedimentation controls shall be in place before the start of clearing, as described in Section 02105 of these Specifications or as shown on the Drawings.
- B. If weather conditions are unsuitable for clearing and grubbing, as determined by the Lead PRP, the Contractor shall cease operations until permission to resume operations is obtained from the Lead PRP or the CQA Consultant.
- C. Grubbing shall consist of the removal of stumps, roots, and surficial debris from within the Limits of Disturbance shown on the Drawings. Vegetation removed during grubbing operations shall be shredded, chipped, or otherwise reduced in size to a maximum dimension of 18 inches. All shredded and chipped vegetation shall be disposed at an offsite facility.

### **3.04 STRIPPING OF TOPSOIL**

- A. Stripping of topsoil shall only be performed in areas indicated on the Drawings and as indicated by the CQA Consultant.
- B. Equipment and methods of operation shall be selected by the Contractor with the intent of minimizing disturbance to surrounding areas.
- C. If soil or weather conditions are unsuitable for topsoil stripping, as determined by the Lead PRP and the CQA Consultant, the Contractor shall cease stripping activities until permission to resume stripping activities is obtained from the CQA Consultant.
- D. Topsoil stripped from the area where there are leachate seeps shall be placed in the Designated Refuse Area as shown on the Drawings.

### **3.05 SOIL STOCKPILING**

- A. Stripped topsoil that is suitable for re-use shall be stockpiled in the approved soil stockpile area(s) or as otherwise identified by the CQA Consultant. Re-usable soils are to be placed in stockpiles of neat configurations and having sideslopes no steeper than 1H:1V. Topsoil stockpiles shall be separated from any other stockpile by a minimum distance of 25 ft and

shall be clearly identified using signs as to which material exists in stockpile. The surface of each stockpile shall be shaped and tracked prior to the end of each working day.

- B. Stockpiles shall be seeded with temporary seeding and mulching if remain inactive for 14 days. Alternatively, the stockpiles may be stabilized by hydroseeding.

### **3.06 SURVEYING AND CONSTRUCTION TOLERANCES**

- A. All surveying shall be performed in accordance with Section 02100 of these Specifications.
- B. Construction tolerances shall be as specified in Section 02200.

### **3.07 PROTECTION OF WORK**

- A. The Contractor shall use all means necessary to protect all prior Work, including all materials and completed Work of other Sections.
- B. In the event of damage, the Contractor shall immediately make all repairs and replacements necessary, at no additional cost to the Lead PRP.

[END OF SECTION]

## **SECTION 02200**

### **EARTHWORK**

#### **PART 1 – GENERAL**

##### **1.01 SCOPE**

- A. This Section covers the requirements for general earthwork related to construction of the cover system, leachate trenches, stormwater management structures and other associated components of the remedy as specified herein and as indicated on the Drawings.
- B. The Contractor's responsibilities shall include, but not necessarily be limited to: excavating, hauling, stockpiling, backfilling, equipment installation and compacting soil materials.

##### **1.02 RELATED SECTIONS**

- A. Section 01065 – Health, Safety, and Emergency Response Requirements
- B. Section 02100 – Surveying
- C. Section 02105 – Erosion and Sediment Control
- D. Section 02110 – Clearing, Grubbing, and Stripping

##### **1.03 REFERENCES**

- A. Latest version of American Society for Testing and Materials (ASTM) standards:
  - 1. ASTM C 136 Standard Method for Sieve Analysis of Fine and Coarse Aggregate.
  - 2. ASTM D 422 Standard Method for Particle-Size Analysis of Soils.
  - 3. ASTM D 698 Standard Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures.
  - 4. ASTM D 1557 Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort .
  - 5. ASTM D 2216 Standard Method for Laboratory Determination of Water (Moisture) Content of Soil, Rock, and Soil-Aggregate Mixtures.
  - 6. ASTM D 2487 Standard Test Method for Classification of Soils for Engineering Purposes.
  - 7. ASTM D 2974 Standard Test Methods for Moisture, Ash, and Organic Matter of Peat and Other Organic Soils.
  - 8. ASTM D 4318 Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.



9. ASTM D 4373 Standard Test Method for Rapid Determination of Carbonate Content of Soils.
  10. ASTM D 4632 Standard Test Method for Grab Breaking Load and Elongation of Geotextiles.
  11. ASTM D 4751 Standard Test Method for Determining Apparent Opening Size of a Geotextile.
  12. ASTM D 4972 Standard Test Method for pH of Soils.
  13. ASTM D 5084 Standard Test Method for Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible-Wall Permeameter.
  14. ASTM D 5261 Standard Test Method for Measuring Mass per Unit Area of Geotextiles.
  15. ASTM D 6193 Standard Practice for Stitches and Seams.
  16. ASTM D 6938 Standard Test Methods for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).
- B. United States Environmental Protection Agency (USEPA) Publication SW-846, "Test Methods for Evaluating Solid Waste Physical/Chemical Methods".
- C. Construction Management Plan (to be prepared by Contractor).
- D. Construction Operations Plan (to be prepared by Contractor).
- E. Construction Quality Assurance Plan (CQAP).
- F. Construction Health and Safety Plan/Contingency Plan (to be prepared by Contractor).
- G. Illinois Department of Transportation (IDOT) Standard Specifications for Road and Bridge Construction.
- H. Boone County Subdivision Regulations, Section 510, as part of the Boone County Code, enacted 19 March 2014.

#### **1.04 SUBMITTALS**

- A. The Contractor shall notify the CQA Consultant in writing at least 7 days prior to the start of earthwork operations.
- B. At least 14 days prior to the start of earthwork operations, the Contractor shall submit to the CQA Consultant an Earthwork and Stockpiling Plan describing the proposed equipment and methods of construction for earthwork-related items such as stripping, stockpiling, excavation, compaction, and backfilling. The Contractor shall not begin

earthwork operations until the plan is reviewed by the CQA Consultant. The Contractor shall, in all cases, remain responsible for the adequacy of safety and methods.

- C. The Contractor shall provide manufacturer's data sheets for various components of Work (e.g., Separator Fabric, piping, etc.) at least 14 days prior to start of Work.
- D. Copies of load tickets, shipping manifests that describe the product, quantity, provider, the date of shipment shall be provided to the CQA Consultant.
- E. Copies of all quality control test results.
- F. Proposed sources for all off-site soil and aggregates. The Contractor shall provide at a minimum grain size information (ASTM C 136 or ASTM D 422, as applicable) and Atterberg limits (ASTM D 4318) for Clay Fill and General Fill. These test results are not intended to be pre-qualification test results. Pre-qualification testing will be conducted by the CQA Testing Laboratory.
- G. The Contractor shall provide to the CQA Testing Laboratory a 150-lb sample from each source of soil or aggregate proposed for use a minimum of 21 days prior to the start of earthwork operations. The CQA Consultant will perform the pre-construction testing set forth in the CQAP to evaluate whether the proposed material meets the Specifications. If the proposed material does not meet the Specifications, any further re-testing or evaluation of alternate sources shall be conducted by the CQA Consultant on samples provided by the Contractor, and at the Contractor's sole expense.
- H. For soils supplied from an off-site source, the Contractor shall submit written evidence, including but not limited to, documented knowledge of the past use of the off-site soil property, at least 21 days prior to the start of earthwork operations. The letter shall include chemical characterization test results based on USEPA Publication SW-846. Chemical characterization results shall meet the requirements of IEPA's Tiered Approach to Corrective Action Objectives (TACO): 35 IAC Part 742.
- I. The Contractor shall provide manufacturer's data sheet and construction guidelines for Fabric Formed Concrete downchutes to the CQA Consultant 21 days prior to commencing the work.
- J. If work is interrupted for reasons other than inclement weather, the Contractor shall notify the CQA Consultant a minimum of 24 hours prior to the resumption of work.

## **1.05 COMPLIANCE WITH REGULATIONS**

- A. It is the sole responsibility of the Contractor to be completely familiar with and to follow all local, state, and federal regulations pertaining to Work required in this Section.

## **1.06 HEALTH AND SAFETY**

- A. The Contractor shall follow all procedures set forth in their approved CHASP.
- B. Any deviations from the CHASP must be submitted to the Engineer in writing prior to being implemented.

## **1.07 CONSTRUCTION QUALITY ASSURANCE**

- A. Construction of the earthwork components of the project shall be monitored by the CQA Consultant as outlined in the CQAP.
- B. The Contractor shall be aware of the activities set forth in the CQAP and shall account for these activities in the construction schedule.
- C. The Contractor shall assist CQA personnel in every manner necessary for the proper performance of activities set forth in the CQAP.
- D. CQA testing or inspections performed by the CQA Consultant in no manner relieves the Contractor of the responsibility to construct all Work to conform to the Drawings and Specifications.
- E. If quality control or quality assurance tests indicate Work does not meet specified requirements, the Contractor shall remove Work, replace and retest at no additional cost to the Lead PRP.

## **1.08 EXISTING CONDITIONS**

- A. The Contractor shall comply with applicable regulations in locating and providing clearance for all underground and above ground utilities prior to beginning construction activities. The Contractor shall immediately notify the Lead PRP and the CQA Consultant if other utility lines or structures, not shown on the Drawings, are encountered. Repair of damage and all restitution for liabilities resulting from damage to existing facilities due to activities by the Contractor shall be at the Contractor's expense.
- B. No work shall be performed in wetlands except for the construction of outflow structures as shown on SESC drawings.

## **PART 2 – PRODUCTS**

### **2.01 CLAY FILL**

- A. Clay Fill shall be obtained from select on-site excavations or imported from an approved off-site source (if needed). Clay Fill shall consist of relatively homogeneous, natural soils that are free of debris, foreign objects, fragments, roots, and organic material. No material with a maximum diameter larger than two (2) inches shall be allowed, and the material shall have a plasticity index between 8 and 30 and not less than 40 percent by weight passing through the standard U.S. No. 200 sieve. Clay Fill shall be classified as CL, CH, ML or MH in accordance with the USCS, or equivalent material approved by the CQA Consultant.
- B. The Contractor shall achieve an in-place compacted clay layer hydraulic conductivity that is no greater than  $1 \times 10^{-7}$  cm/s.
- C. Clay Fill from off-site sources shall be free of materials containing hazardous or toxic constituents at hazardous or toxic concentrations. Chemical characterization results shall meet the requirements of IEPA's Tiered Approach to Corrective Action Objectives (TACO): 35 IAC Part 742.
- D. Substandard materials shall be segregated at the source and will not be permitted at the work area. Any material which is found by the CQA Consultant to be substandard shall be removed from the work area by the Contractor. Material that does not meet the property requirements for Clay Fill may be considered for use as the Vegetative Layer or General Fill, provided it meets the material property requirements set forth in this Section.

### **2.02 GENERAL FILL**

- A. General Fill shall be obtained from select on-site excavations or imported from an approved off-site source (if needed). General Fill shall consist of relatively homogeneous, natural soils that are free of debris, foreign objects, fragments, roots, and organic material. No material with a maximum diameter larger than two (2) inches shall be allowed, and the material shall have a maximum plasticity index of 40. General Fill shall be classified as ML, CL, MH, or CH in accordance with the USCS, or equivalent material approved by the CQA Consultant.
- B. General Fill from off-site sources shall be free of materials containing hazardous or toxic constituents at hazardous or toxic concentrations. Chemical characterization results shall meet the requirements of IEPA's Tiered Approach to Corrective Action Objectives (TACO): 35 IAC Part 742.

### **2.03 ROAD SURFACE COURSE & STRUCTURAL FILL**

- A. Road Surface Course and Structural Fill shall meet the requirements of IDOT Standard Specifications for Road and Bridge Construction, Section 1004.1, Gradation No. CA-6, Quality Class A (see Table 02200-1).

### **2.04 ROAD BASE AGGREGATE**

- A. Road Base Aggregate shall meet the requirements of IDOT Standard Specifications for Road and Bridge Construction, Section 1004.1, Gradation No. CA-1, Quality Class A (see Table 02200-1).

### **2.05 SEPARATOR FABRIC**

- A. Separator Fabric shall be a nonwoven geosynthetic and meet the minimum requirements set forth in Table 02200-2.
- B. The Contractor shall protect Separator Fabric from sunlight, moisture, excessive heat or cold, puncture, mud, dirt, and dust or other damaging or deleterious conditions. Contractor shall follow all geotextile manufacturer recommendations for handling and storage.
- C. The Contractor shall store geotextile rolls on pallets or other elevated structures, and shall not store geotextile rolls directly on the ground.
- D. Outdoor storage of rolls shall not exceed the manufacturer's recommendation or longer than six months, whichever is less.

### **2.06 VEGETATIVE SOIL LAYER**

- A. The upper approximately six inches of the existing ground that will be stripped over the areas shown on the Drawings will be utilized as Vegetative Soil Layer. If the stripped existing topsoil is not enough for final cover construction, additional Vegetative Soil Layer will be provided from an off-site source:
- B. Vegetative Soil Layer shall have a minimum of five (5) percent organic content and consist of relatively homogeneous, natural soils that are free of debris, foreign objects, and large rock fragments. No material with a maximum diameter larger than three (3) inches shall be allowed, and the material shall have maximum plasticity index of 40. Vegetative soil shall be classified as GM, GC, SM, SC, ML, CL, MH, or CH material in accordance with the USCS, or equivalent material approved by the CQA Consultant.

- C. Vegetative Soil Layer from off-site sources shall be free of materials containing hazardous or toxic constituents at hazardous or toxic concentrations. Chemical characterization results shall meet the requirements of IEPA's Tiered Approach to Corrective Action Objectives (TACO): 35 IAC Part 742.

## **2.07 PIPE BEDDING**

- A. Pipe Bedding shall meet the requirements of IDOT Standard Specifications for Road and Bridge Construction, Section 1004.1, Gradation No. CA-6, Quality Class A (see Table 02200-1). Pipe Bedding shall consist of crushed stone and not rounded particles.

## **2.08 DOWNCHUTE BEDDING**

- A. Downchute Bedding shall meet the requirements of General Fill.

## **2.09 TRENCH BACKFILL**

- A. Trench Backfill shall be a washed non-calcareous rock that meets the gradation specifications for the IDOT Standard Specifications for Road and Bridge Construction, Section 1003.1, Gradation No. CA-5.

## **2.10 EQUIPMENT**

- A. Furnish equipment necessary to perform Work specified in this Section.
- B. It is highly recommended that the Contractor utilizes equipment with GPS units due to nature of irregular grades.

# **PART 3 – EXECUTION**

## **3.01 FAMILIARIZATION**

- A. Prior to implementing any part of Work described in this Section, the Contractor shall become thoroughly familiar with the site, the site conditions, and all portions of Work within this Section.
- B. Prior to implementing any part of Work in this Section, the Contractor shall carefully inspect the installed Work of all other Sections and verify that all Work is complete to the point where the Work of this Section may properly commence without adverse impact.

### **3.02 EROSION AND SEDIMENT CONTROL**

- A. Prior to implementing any part of Work described in this Section, the Contractor shall install all erosion and sediment controls as described in Section 02105, in the relevant area(s) of construction.

### **3.03 SITE PREPARATION**

- A. Any stormwater diversion/retention features needed for erosion and sediment control or protection of Work, shall be installed by the Contractor at the start of site preparation.
- B. Clearing, grubbing, and stripping to prepare areas requiring placement of earthwork shall be conducted by the Contractor as set forth in Section 02110.

### **3.04 STOCKPILING**

- A. All stockpiles shall be located at designated areas shown on the Drawings or on the Contractor's Earthwork and Stockpiling Plan as approved by the CQA Consultant. Stockpiles shall be of neat configurations and having sideslopes no steeper than 2H:1V. Stockpiles of different construction materials shall be separated by a minimum distance of 25 ft and shall be clearly identified as to which material exists in each stockpile by use of weather resistant signs.
- B. Stockpiles shall be stabilized with temporary seeding and mulching in accordance with the requirements of Section 02105. Alternatively, the stockpiles may be stabilized by hydroseeding.

### **3.05 CLAY FILL THICKNESS VERIFICATION**

- A. The total Clay Fill shall be a minimum of three feet thick after construction, including the existing Clay Fill.
- B. Portions of the top of the landfill will be excavated to achieve final grades. The majority of the excavation at the top of the landfill ranges from one to two feet with an isolated area where up to five feet of excavation is required to achieve final grades.
- C. For the top of landfill, prior to the start of excavation, the Contractor shall stake out the extent of the excavation areas and measure the thickness of Clay Fill through a hand auger hole advanced perpendicular to the existing grade. One hand auger shall be advanced for every 100-ft x 100-ft grid or an equivalent area by the Contractor. Holes shall be plugged with granular sodium bentonite compacted in 3-in lifts. If the thickness of existing Clay Fill is such that minimum 3-ft thick Clay Fill cannot be established

based on the current design grades, the Engineer will provide new grading information to the Contractor. The Contractor will be compensated for any additional fill based on the approved unit rates.

- D. For the side slopes where additional Clay Fill will be placed to achieve a minimum of 3 ft, the Contractor shall advance a hand auger hole advanced perpendicular to the grade for every 100-ft grid or equivalent area after existing topsoil is stripped. Clay Fill thickness shall be minimum of 3 ft with the additional Clay Fill. If Clay Fill thickness would be less than 3 ft with the additional Clay Fill, the Contractor is responsible to place additional Clay Fill to obtain minimum 3-ft thickness and achieve minimum of 3 percent grade. The Contractor will be compensated for additional Clay Fill based on unit rates provided in the bid forms. The Contractor is responsible to provide survey information to the CQA Consultant for verification of Clay Fill amount.

### **3.06 PLACEMENT AND COMPACTION OF EARTHWORK MATERIALS**

#### **A. Clay Fill**

1. Clay Fill obtained from the west borrow area shall be compacted to minimum 94 percent of maximum dry density and to a moisture content that is between 0.5 to 3.5 percent above optimum moisture content as measured in accordance with ASTM D 698. Clay Fill compaction criteria for the offsite source will be established based on the results of flexible wall permeability test (ASTM D 5084) that will be conducted as part of the pre-construction qualification and conformance testing during construction in accordance with the CQAP. It is the Contractor's responsibility to achieve an in-place hydraulic conductivity that is no greater than  $1 \times 10^{-7}$  cm/s based on ASTM D 5084.
2. Strip the existing topsoil and disk to minimum 4-in depth. Adjust the moisture content of disked soil to an acceptable moisture content range before mixing with additional Clay Fill.
3. The CQA Consultant will check the condition of existing Clay Fill with a pocket penetrometer only at the existing seep locations after stripping of topsoil. If the existing Clay Fill at seep locations exhibit a pocket penetrometer reading of less 1 tsf, the Contractor shall remove the existing Clay Fill up to 4 yd<sup>3</sup> or until directed by the CQA Consultant.
4. Lifts shall not exceed nine inches of loose thickness and six (6) inches in compacted thickness. The first lift shall include the disked soil.



5. Clay Fill shall be compacted with a minimum of three (3) full coverage passes (a full coverage pass is defined as one back-and-fourth trip of the compactor) with a sheepsfoot or padfoot roller.
6. Clay Fill shall be placed as soon as possible after stripping of the existing topsoil to prevent desiccation, cracking or freezing.
7. The Contractor shall assume full responsibility for conditioning and further compacting Clay Fill as needed to meet the target compaction and permeability criteria and make the soil workable for their selected equipment and methods.
8. All additional moisture conditioning and/or further compaction beyond the specified minimum of three full coverage passes shall be performed by the Contractor at no additional cost to the Lead PRP.
9. The Contractor shall determine water source type and availability and make arrangements for obtaining water for moisture conditioning Clay Fill. Water from nearby flowing water bodies (streams and rivers) shall not be used as a water source for soil moisture conditioning.
10. Prior to placing a subsequent lift, the Contractor shall scarify the surface (i.e., previous lift) to a depth of two (2) inches by tracking with a dozer or using an equivalent method as approved by the CQA Consultant. The scarified surface shall be moisture conditioned, if necessary.
11. Hand compaction shall be used in leachate collection trenches and around the existing structures (e.g., gas vents). Care shall be taken to protect piping and other structures. Damage to any materials or work caused by hand compaction shall be repaired by the Contractor.
12. At the beginning of each day's work, the previously placed Clay Fill layer material will be inspected by the CQA Consultant. The CQA Consultant may require reworking and recompaction of previously placed material in accordance with guidelines of this Section.
13. The Contractor shall not commence placement and compaction of Clay Fill until the CQA Consultant completes the evaluation of the subgrade conditions and the conformance evaluation of previous layer.
14. Standing water, and/or saturated wet soil conditions shall not be tolerated in areas of the subgrade or previous lifts of Clay Fill at the time that subsequent Clay Fill is placed and compacted.

15. No frozen or thawing soil shall be placed, spread or compacted. No Clay Fill shall be placed, spread, or compacted while the subgrade is frozen or thawing, during unfavorable weather conditions, or during periods of significant precipitation.
16. The Contractor shall process Clay Fill if needed to achieve a homogenous moisture content and consistency to meet compaction criteria. The equipment and methods must be capable of reducing the clod size of the soil to less than three (3) inches.
17. The Contractor shall finish each day's work with a smooth-drum roller to create a smooth surface, free from ruts or indentations, to minimize moisture penetration.
18. The entire construction area shall be left in a manner to promote proper drainage of surface water at the end of each day.
19. If a defective area is discovered in the compacted clay layer, the CQA Consultant will determine the extent and nature of the defect. If the defect is indicated by an unsatisfactory test result, the CQA Consultant will determine the extent of the defective area by additional tests, observations, a review of records, or other means that the CQA Consultant deems appropriate. If the defect is related to adverse site conditions, such as overly wet soils or surface desiccation, the CQA Consultant will define the limits and nature of the defect.
20. After the extent and nature of a defect have been determined, the Contractor shall correct the deficiency to the satisfaction of the CQA Consultant.
21. Additional testing will be performed by the CQA Consultant to verify that the defect has been corrected. This additional testing will be performed before any additional work is allowed in the area of deficiency.

B. General Fill

1. Each lift of shall be compacted to at least 95 percent of the maximum dry unit weight as determined from the standard Proctor compaction test (ASTM D 698).
2. General Fill shall be placed in loose lifts of not more than 12 inches, and compacted lift thickness shall be no more than 9 inches.
3. General Fill shall be compacted with a minimum of three (3) full coverage passes (a full coverage pass is defined as one back-and-fourth trip of the compactor).
4. Prior to placing a subsequent lift, the Contractor shall scarify the existing surface (i.e., previous lift) to a depth of two (2) inches by tracking with a dozer or using an

equivalent method as approved by the CQA Consultant.

5. If the moisture content of the General Fill is too dry or too wet to achieve acceptable compaction, the soil shall be wetted or dried, as appropriate. Wetting shall be accomplished by the Contractor using a water truck and spray nozzle or spreader bar unless otherwise approved by the CQA Consultant. During wetting or drying, the soil shall be processed routinely by disking or other mixing equipment so that uniform moisture conditions are attained. Any delays in progress due to soil moisture conditioning are the sole responsibility of the Contractor.
6. No fill shall be placed over a lift which has not been tested and approved by the CQA Consultant. Should the CQA tests indicate that the dry unit weight of any layer of fill, or portion thereof, is below the minimum acceptable value, the particular layer or portion shall be reworked and recompactd at no additional cost to the Lead PRP.
7. The Contractor shall not place frozen fill, nor shall the Contractor place fill on frozen ground.

C. Road Surface Course and Structural Fill

1. Each lift shall be placed in six (6) inch loose lifts and shall be compacted to a minimum of 93 percent of the maximum dry density as determined from ASTM D 1557.
2. Compaction shall be performed with a minimum of four full coverage passes from a smooth drum roller. A full coverage pass is defined as one back-and-fourth trip of the compactor.

D. Road Base Aggregate

1. Prior to placement of Road Base Aggregate for the access road between the central storage tank and bituminous pavement south of the entrance, the subgrade will be evaluated by the CQA Consultant. At the direction of the CQA Consultant, the subgrade shall be proof rolled using a loaded rubber-tired truck or a smooth drum roller where necessary to evaluate the firmness of the subgrade. If ruts deeper than two inches are observed by the CQA Consultant, The Contractor shall replace the top 18 inches with Structural Fill and re-proof test it.
2. Compact Road Base Aggregate with a minimum of six coverage using smooth drum roller. The density of the compacted surface shall be certified by the CQA Consultant based on visual observations confirming the stiffness of the compacted ground.

E. Separator Fabric

1. Place Separator Fabric as shown on the Drawings.
2. The Contractor shall handle Separator Fabric so as to ensure it is not damaged.
3. After unwrapping Separator Fabric from its opaque cover, the Contractor shall not leave it exposed for a period in excess of 30 calendar days.
4. Separator Fabric shall be placed and continuously sewn with double-row Type 401 two-thread chain stitch in accordance with ASTM D 6193.
5. Any holes or tears in Separator Fabric shall be repaired by sewing or thermally bonding a patch made from the same geotextile over the affected area, with a minimum of three (3) feet of overlap in all directions. All repairs of Separator Fabric shall be observed by the CQA Consultant.
6. The Contractor shall place materials on top of Separator Fabric in such a manner as to ensure that: (i) Separator Fabric and the underlying materials are not damaged; and(ii) slippage does not occur between Separator Fabric and the underlying layers during placement.
7. The Contractor shall spread aggregate on top of Separator Fabric to cause soil to cascade over Separator Fabric rather than be shoved across the Separator Fabric.
8. The Contractor shall not drive equipment directly on Separator Fabric. The Contractor shall only use equipment above a geotextile that meets the following ground pressure requirements:

<b>Maximum Allowable Equipment Ground Pressure (pounds per square inch)</b>	<b>Minimum Thickness of Overlying Soil (inches)</b>
<5	12
<10	18
<20	24
>20	36

F. Vegetative Soil Layer

1. Vegetative Soil Layer shall be six (6) inches thick within the landfill boundary and three (3) inches thick outside of the landfill boundary. Vegetative Soil Layer shall be tracked parallel to the side slope by a dozer prior to applying erosion control measures as described on the Drawings and Section 02105 of the Specifications.

G. Pipe Bedding

1. Pipe Bedding shall be placed in maximum 8-in loose lifts and compacted to 90 percent of the Proctor as determined by ASTM D 698. Hand-tampers should be used for areas not accessible rollers and compactors. Extreme care shall be taken to avoid damage to conduits and pipes.

H. Downchute Bedding

1. Downchute Bedding shall meet the requirements of General Fill.

I. Trench Backfill

1. Trench Backfill shall be placed in maximum 6-in loose lifts and packed to interlock aggregate particles. Density of Trench Backfill will be certified by the CQA Consultant based on visual inspection.

**3.07 PUMPING AND DRAINAGE**

- A. At all times during construction, the Contractor shall provide and maintain proper equipment and facilities to remove all water entering the construction area (including the borrow area) so as to obtain satisfactory working conditions.
- B. The Contractor shall be responsible for controlling ground-water, surface-water run-off and run-on around the construction area, at no additional cost to the Lead PRP.
- C. Surface water shall be pumped or drained from the construction area in order to maintain the construction area free from standing water. Surface water shall be pumped or drained in a manner which prevents flow or seepage back into the construction area. In all cases, the Contractor shall pump from a sump pit in accordance with the soil erosion and sediment control plan drawings.

**3.08 DUST CONTROL**

- A. Water and/or dust suppressants shall be applied by the Contractor as needed, or as directed by the CQA Consultant, in order to control dust during construction. Dust control shall be

performed in accordance with Section 01032. Dust control shall be performed at no additional cost to the Lead PRP.

### **3.09 SURVEYING AND CONSTRUCTION TOLERANCES**

- A. All surveying to achieve construction tolerances shall be performed in accordance with Section 02100.

### **3.10 PROTECTION OF WORK**

- A. The Contractor shall use all means necessary to protect all prior work, including all materials and completed work of other Sections.
- B. In the event of damage to prior work or existing structures, the Contractor shall immediately make all repairs and replacements necessary, at no additional cost to the Lead PRP.

**TABLE 02200-1**

**IDOT STANDARD SPECIFICATIONS FOR ROAD AND BRIDGE CONSTRUCTION  
AGGREGATE GRADATION**

	COARSE AGGREGATE GRADATIONS												
Grad No.	Sieve Size and Percent Passing												
	3 in.	2 1/2 in.	2 in.	1 1/2 in.	1 in.	3/4 in.	1/2 in.	3/8 in.	No. 4	No. 8	No. 16	No. 50	No. 200 <sup>1/</sup>
CA 1	100	95±5	60±15	15±15	3±3								
CA 2		100	95±5		75±15		50±15		30±10		20±15		8±4
CA 3		100	93±7	55±20	8±8		3±3						
CA 4			100	95±5	85±10		60±15		40±10		20±15		8±4
CA 5				97±3 <sup>2/</sup>	40±25		5±5		3±3				
CA 6				100	95±5		75±15		43±13		25±15		8±4
CA 7				100	95±5		45±15 <sup>3/8/</sup>		5±5				
CA 8				100	97±3	85±10	55±10		10±5		3±3 <sup>4/</sup>		
CA 9				100	97±3		60±15		30±15		10±10		6±6
CA 10					100	95±5	80±15		50±10		30±15		9±4
CA 11					100	92±8	45±15 <sup>5/8/</sup>		6±6		3±3 <sup>4/ 6/</sup>		
CA 12						100	95±5	85±10	60±10		35±10		
CA 13						100	97±3	80±10	30±15		3±3 <sup>4/</sup>		
CA 14							90±10 <sup>7/</sup>	45±20	3±3				
CA 15							100	75±15	7±7		2±2		
CA 16							100	97±3	30±15		2±2 <sup>4/</sup>		
CA 17	100								65±20		45±20	20±10	10±5
CA 18	100				95±5				75±25		55±25	10±10	2±2
CA 19	100				95±5				60±15		40±15	20±10	10±5
CA 20							100	92±8	20±10	5±5	3±3		

<sup>1/</sup> Subject to maximum percent allowed in Coarse Aggregate Quality table.

**TABLE 02200-2**

**REQUIRED PROPERTY VALUES FOR SEPARATOR FABRIC**

PROPERTIES	QUALIFIER	UNITS <sup>(5)</sup>	SPECIFIED VALUES	TEST METHOD
<u>Type</u>				
Nonwoven needlepunched				(-)
Polymer composition <sup>(1)</sup>	minimum	%	95	(-)
Mass per unit area	minimum	oz/yd <sup>2</sup>	8	ASTM D 5261
Thickness	minimum	mil	90	ASTM D 5199
<u>Filter Requirements</u>				
Apparent opening size (O <sub>95</sub> )	maximum	mm	0.15	ASTM D 4751
Permittivity	minimum	sec <sup>-1</sup>	1.5	ASTM D 4491
<u>Mechanical Requirements</u>				
Grab strength	minimum	lb	200	ASTM D 4632 <sup>(2)</sup>
Tear strength	minimum	lb	50	ASTM D 4533 <sup>(3)</sup>
Puncture strength	minimum	lb	80	ASTM D 4833 <sup>(4)</sup>
Burst strength	minimum	psi	285	ASTM D 3786
<u>Durability</u>				
Ultraviolet Resistance	minimum	%	70	ASTM D 4355

Notes:

- (1) All values represent minimum average roll values. Polymer composition of geotextile separator shall be polypropylene or polyester.
- (2) Minimum of values measured in machine and cross machine directions with 1 inch clamp on Constant Rate of Extension (CRE) machine.
- (3) Minimum value measured in machine and cross machine direction.
- (4) Tension testing machine with a 1.75-inch diameter ring clamp, the steel ball being replaced with 0.31-inch diameter solid steel cylinder with flat tip centered within the ring clamp.
- (5)

mm	=	millimeter	%	=	percent
oz/yd <sup>2</sup>	=	ounce per square yard	sec	=	second
lb	=	pound	psi	=	pounds per square inch

[END OF SECTION]



## **SECTION 02300**

### **LEACHATE AND GAS COLLECTION SYSTEM PIPES, FITTINGS, AND TRENCHES**

#### **PART 1 - GENERAL**

##### **1.01 SCOPE**

- A. The Contractor shall furnish all labor, materials, tools, supervision, transportation, installation equipment, and incidentals necessary to install leachate and gas collection system trenching, lateral and header pipes, fittings, and control valves, as indicated on the Drawings.

##### **1.02 RELATED SECTIONS**

- A. Section 01065 – Safety, Health, and Emergency Response Requirements
- B. Section 02100 – Surveying
- C. Section 02200 – Earthwork
- D. Section 02105 – Erosion and Sediment Control
- E. Section 04050 – Common Work Results for Process Integration
- F. Section 04060 – Flushing and Disinfection of Piping
- G. Section 04070 – Leak Testing of Piping
- H. Section 04080 – Steel Process Piping
- I. Section 04090 – Plastic Process Piping
- J. Section 04100 – HDPE Process Piping
- K. Section 04110 – Common Work Results for Process Valves
- L. Section 04120 – Stainless Steel Process Valves
- M. Section 04130 – Plastic and Plastic Lined Process Valves
- N. Section 04140 – Air Relief Valves

- O. Section 04200 – Level Process Measurement Devices
- P. Section 04300 – Instrumentation and Control for Process Systems
- R. Section 05100 – Common Work Results for Process Gas & Liquid Handling, Purification, and Storage Equipment
- S. Section 05110 – Centrifugal Liquid Pump for the Central Storage Tank
- T. Section 05120 – Sump Liquid Pumps for the Underground Tanks
- U. Section 05130 – Above Ground Central Storage Tank
- V. Section 05140 – Underground Storage Tanks

### **1.03 REFERENCES**

- A. Construction Management Plan (to be prepared by Contractor).
- B. Construction Operations Plan (to be prepared by Contractor).
- C. Construction Quality Assurance Plan (CQAP).
- D. Construction Health and Safety Plan/Contingency Plan (to be prepared by Contractor).
- E. Latest version of the American Society for Testing and Materials (ASTM) standards:
  - 1. ASTM C 136 Standard Method for Sieve Analysis of Fine and Coarse Aggregate.
  - 2. ASTM D 422 Standard Method for Particle-Size Analysis of Soils.
  - 3. ASTM D 1248 Standard Specification for Polyethylene Plastics Molding and Extrusion Materials.
  - 4. ASTM F 714 Standard Specification for Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Outside Diameter.

### **1.04 SUBMITTALS**

- A. The Contractor shall prepare and submit to the CQA Consultant at least 30 days prior to delivery:

1. Certificates of Compliance on materials furnished, and manufacturer's brochures containing complete information and instructions pertaining to the storage, handling, installation, and inspection of all leachate and gas collection system components.
- B. Proposed sources for all off-site soil and aggregates. The Contractor shall provide at a minimum grain size information (ASTM C 136 or ASTM D 422, as applicable) for proposed soil and aggregates. These test results are not intended to be pre-qualification test results. Pre-qualification testing will be conducted by the CQA Testing Laboratory.
- C. The Contractor shall provide to the CQA Testing laboratory a 150-lb sample from each source of soil or coarse aggregate material proposed for use in the leachate and gas collection system trenches, a minimum of 21 days prior to the start of associated work. The CQA Consultant will perform the pre-construction testing set forth in the CQAP to evaluate whether the proposed material meets the Specifications. If the proposed material does not meet the Specifications, any further re-testing or evaluation of alternate sources shall be conducted by the CQA Consultant on samples provided by the Contractor, and at the Contractor's sole expense.
- D. The Contractor shall submit the following to the CQA Consultant 14 days prior to work:
  1. Welder certifications; and
  2. Connection detail between aluminum turbine vent and HDPE riser pipe.
- E. The Contractor shall submit to the CQA Consultant as-built drawings of the constructed leachate and gas collection system within 30 days after completion of the system installation.

## **1.05 COMPLIANCE WITH REGULATIONS**

- A. It is the sole responsibility of the Contractor to be completely familiar with and to follow all local, state, and federal regulations pertaining to the work required in this Section.

## **1.06 HEALTH AND SAFETY**

- A. The Contractor shall follow all procedures set forth in their approved Construction Health and Safety Plan/Contingency Plan.
- B. Any deviations from the Construction Health and Safety Plan/Contingency Plan must be submitted to the CQA Consultant and the Engineer in writing prior to being implemented.

## **1.07 CONSTRUCTION QUALITY ASSURANCE**

- A. Work related to the leachate and gas collection system shall be monitored by the CQA Consultant as outlined in the CQAP.
- B. The Contractor shall be aware of the activities set forth in the CQAP and shall account for these activities in the construction schedule.
- C. The Contractor shall assist CQA personnel in every manner necessary for the proper performance of activities set forth in the CQAP.
- D. CQA testing or inspections performed by the CQA Consultant in no manner relieves the Contractor of the responsibility to construct all work to conform to the Drawings and Specifications.
- E. If quality control or quality assurance tests indicate Work does not meet specified requirements, the Contractor shall remove Work, replace and retest at no additional cost to the Lead PRP.

## **1.08 EXISTING CONDITIONS**

- A. The Contractor shall immediately notify the Lead PRP and the CQA Consultant if other utility lines or structures, not shown on the Drawings, are encountered. Repair of damage and all restitution for liabilities resulting from damage to existing facilities due to activities by the Contractor shall be at the Contractor's expense. The Contractor shall comply with applicable regulations in locating and providing clearance for all underground and above ground utilities prior to beginning construction activities.

## **PART 2 – PRODUCTS**

- A. Manufacturer shall mark each length of pipe and all couplings and fittings with the trade name, nominal size, material designation, and class.
- B. All HDPE pipe shall be SDR 17, unless otherwise indicated on the Drawings. Leachate Collection Pipe is perforated 6-in diameter single wall HDPE pipe. The perforation pattern is provided in the Drawings.
- C. Leachate Transmission Pipe is a double wall solid HDPE pipe consisting of 6-in diameter inner pipe and 10-in diameter outer pipe.
- D. Force Mains within the edge of waste are solid 2-in and 4-in diameter single wall HDPE pipes for the southeast underground tank and northwest underground tank, respectively.

Force Main outside of the edge of waste is a double wall solid HDPE pipe consisting of 2-in diameter inner pipe and 4-in diameter outer pipe for the southeast underground tank. Force Main outside of the edge of waste for the northwest underground tank is a double wall solid HDPE pipe consisting of 4-in diameter inner pipe and 8-in diameter outer pipe.

- E. Detailed product information for all piping, fittings, valves and other accessories are provided in Sections 04080 through 05140.
- F. Separator Fabric, Clay Fill and Vegetative Soil Layer specifications are provided in Section 02200.
- G. Cement-Bentonite Grout Fill shall consist of water, Portland cement and sodium bentonite at weight ratios 2.5, 1 and 0.3, respectively.
- H. Pipe Bedding shall meet the requirements of IDOT Standard Specifications for Road and Bridge Construction, Section 1004.1, Gradation No. CA-6, Quality Class A (see Table 02300-1). Pipe Bedding shall consist of crushed stone and not rounded particles.
- I. Trench Backfill shall be a washed non-calcareous rock that meets the gradation specifications for the IDOT Standard Specifications for Road and Bridge Construction, Section 1003.1, Gradation No. CA-5, (see Table 02300-1).

## **PART 3 - EXECUTION**

### **3.01 FAMILIARIZATION**

- A. Prior to implementing any of the work described in this Section, the Contractor shall become thoroughly familiar with the site, the site conditions, and all portions of the work falling within this Section.
- B. Prior to implementing any of Work in this Section, the Contractor shall carefully inspect the installed Work of all other Sections and verify that all Work is complete to the point where Work of this Section may properly commence without adverse impact.

### **3.02 CONSTRUCTION OF LEACHATE AND GAS COLLECTION TRENCHES**

- A. Underground and above ground storage tanks shall be in place prior to start of trench excavation. Install tanks, pumps, piping and secondary containment for the above ground storage tank in accordance Division 4, Division 5 and Division 6 of the Specifications.

- B. The Contractor shall stake the control points along the trench alignment and provide survey results back to the CQA personnel. Excavation shall not start without the CQA Certifying Engineer's approval of the survey results.
- C. Trench excavation shall start downstream (low design elevation) and progress towards upstream (design high point). If the underground storage tanks reach their capacity before mechanical and electrical connections are established between the underground storage tanks and the above ground central storage tank, the Contractor shall haul or pump stormwater/leachate from the underground storage tanks to the central storage tank for removal by others.
- D. Trenching shall be performed in accordance with OSHA safety regulations for excavation and trenching safety.
- E. Soil removed from trenches shall be stockpiled at approved stockpile locations for later use.
- F. It is the Contractor's responsibility to keep the bottom of trench and side walls stable during construction of the leachate and gas collection system.
- G. Waste that is removed from trenches shall be placed in the Designated Refuse Area shown on the Drawings. Article 3.03 of this section provides more information on waste handling and related earthwork activities.
- H. All protruding objects that may damage the Separator Fabric shall be removed from the surface before placement of the Separator Fabric. Separator Fabric shall then be placed in the bottom, around the sides of the trench and overlap minimum two feet at the top of Trench Backfill and heat tacked in accordance with the details shown on the Drawings.
- I. Place piping and backfill with Trench Backfill or Pipe Bedding in accordance with details shown on Drawings.
- J. Place Clay Fill and Vegetative Soil Layer to final grades after placement of Separator Fabric and Trench Backfill for the sections of the trench within the edge of waste in accordance with specification 02200. For the sections outside of the edge of waste, place existing soil and Vegetative Soil Layer to final grades after placement of Pipe Bedding in accordance with the Drawings.

- K. When placing Cement-Bentonite Grout Fill, cement and water shall be mixed prior to mixing bentonite.
- L. Construct the clean out and passive vent risers at locations in accordance with the Drawings.
- M. Trench shall be carefully backfilled and compacted around the pipes.
- N. Pipe Bedding shall be placed in maximum 8-in loose lifts and compacted to 90 percent of the Proctor as determined by ASTM D 698. Hand-tampers should be used for areas not accessible rollers and compactors. Extreme care shall be taken to avoid damage to conduits and pipes.
- O. Trench Backfill shall be placed in 6-in loose lifts and packed to interlock aggregate particles. Density of Trench Backfill will be certified by the CQA Consultant based on visual inspection.
- P. Construction fencing shall be installed along any open trenches at the end of each construction day if the trench is not backfilled to grade.

### **3.03 WASTE REMOVAL AND RELOCATION**

- A. Waste generated during construction of leachate and gas collection system including general earthwork activities shall be relocated to the Designated Refuse Area shown in the Drawings.
- B. Waste shall be loaded into a truck, front end loader, etc. upon excavation and disposed at the Designated Refuse Area. Waste shall not be stockpiled anywhere on the landfill.
- C. Prior to placement of waste in the Designated Refuse Area, the Contractor shall strip the existing topsoil and excavate the part of the existing Clay Fill and stockpile them separately at the approved stockpile locations for later reuse. It is the Contractor's responsibility to maintain a stable excavation area. In no cases shall the side slopes be steeper than 2.5H:1V.
- D. The Contractor shall excavate the Designated Refuse Area as needed; only the area necessary for three (3) days use shall be excavated at one time.
- E. Storm water run-on shall be prevented from entering the Designated Refuse Area with placement of berms around the perimeter of the Designated Refuse Area.

- F. Waste shall be placed in lifts not to exceed two (2) feet in loose-lift thickness. Each lift shall be compacted using a minimum of two (2) full-coverage compaction passes.
- G. Waste shall be compacted with a heavy static tamping foot compactors with minimum operating weight of 35,000 lb (e.g., Caterpillar 815B, 825C, 816B, or 826C)
- H. Prior to the end of each working day, the Contractor shall cover all exposed waste with a minimum of 6-in thick daily cover soil. In no cases shall waste be left exposed overnight.
- I. Waste placement in the Designated Refuse Area shall stop at a minimum 4.5 ft below final grade. The Contractor shall build one foot of compacted General Fill for a bridging layer before placing the minimum 3-ft thick Clay Fill.
- J. Stormwater removed from the Designated Refuse Area shall only be pumped to the central storage tank.

#### **3.04 HDPE PIPE INSTALLATION**

- A. See Section 04100 of the Specifications for detailed information on HDPE pipe installation.

#### **3.05 LEAK TESTING OF HDPE PIPES**

- A. See Section 04070 of the Specifications for detailed information on leak testing of solid wall pipes.

#### **3.06 SURVEYING AND CONSTRUCTION TOLERANCES**

- A. All surveying shall be performed in accordance with Section 02100.
- B. Tolerances: The Contractor shall construct the leachate and gas collection system components to within +/-0.2 feet of locations indicated on the Drawings, unless otherwise approved by the CQA Consultant. However, in all cases, leachate and gas collection system shall drain in the directions shown on the Drawings at a minimum of 0.5% grade.
- C. Furnish exact location and description of buried pipelines and associated utilities.
- D. Incorporate information on As-Built Drawings.



### 3.07 PROTECTION OF WORK

- A. The Contractor shall use all means necessary to protect all prior work, including all materials and completed work of other Sections.
- B. In the event of damage, the Contractor shall immediately make all repairs and replacements necessary, to the approval of the CQA Consultant at no additional cost to the Lead PRP.

**TABLE 02300-1**

### IDOT STANDARD SPECIFICATIONS FOR ROAD AND BRIDGE CONSTRUCTION AGGREGATE GRADATION

Grad No.	COARSE AGGREGATE GRADATIONS												
	Sieve Size and Percent Passing												
	3 in.	2 1/2 in.	2 in.	1 1/2 in.	1 in.	3/4 in.	1/2 in.	3/8 in.	No. 4	No. 8	No. 16	No. 50	No. 200 <sup>1/</sup>
CA 1	100	95±5	60±15	15±15	3±3								
CA 2		100	95±5		75±15		50±15		30±10		20±15		8±4
CA 3		100	93±7	55±20	8±8		3±3						
CA 4			100	95±5	85±10		60±15		40±10		20±15		8±4
CA 5				97±3 <sup>2/</sup>	40±25		5±5		3±3				
CA 6				100	95±5		75±15		43±13		25±15		8±4
CA 7				100	95±5		45±15 <sup>3/8/</sup>		5±5				
CA 8				100	97±3	85±10	55±10		10±5		3±3 <sup>4/</sup>		
CA 9				100	97±3		60±15		30±15		10±10		6±6
CA 10					100	95±5	80±15		50±10		30±15		9±4
CA 11					100	92±8	45±15 <sup>5/8/</sup>		6±6		3±3 <sup>4/ 6/</sup>		
CA 12						100	95±5	85±10	60±10		35±10		
CA 13						100	97±3	80±10	30±15		3±3 <sup>4/</sup>		
CA 14							90±10 <sup>7/</sup>	45±20	3±3				
CA 15							100	75±15	7±7		2±2		
CA 16							100	97±3	30±15		2±2 <sup>4/</sup>		
CA 17	100								65±20		45±20	20±10	10±5
CA 18	100				95±5				75±25		55±25	10±10	2±2
CA 19	100				95±5				60±15		40±15	20±10	10±5
CA 20							100	92±8	20±10	5±5	3±3		

<sup>1/</sup> Subject to maximum percent allowed in Coarse Aggregate Quality table.

[END OF SECTION]

**SECTION 02400**  
**PIPE ABANDONMENT**

**PART 1      GENERAL**

**1.01   SCOPE**

- A.    Abandonment existing leachate collection pipe in place, by cutting and capping after filling completely with flowable fill.
- B.    Safety
  - 1.    The Contractor shall be familiar with, and shall at all times conform to, the regulations of the “*OSHA General Industry Occupational Safety and Health Standards*,” “*OSHA Safety and Health Regulations for Construction*,” and other applicable state and municipal standards and regulations.

**1.02   SUBMITTALS**

- A.    Submit product data for proposed plugs for approval.
- B.    Technical information for equipment and operational procedures including projected slurry injection rate, grout pressure, method of controlling grout pressure, bulkhead, relief vent design and number of stages of grout application.
- C.    At least 15 days prior to commencing abandonment activities, submit plan for abandonment, describing proposed mix design, corresponding strength test results, grouting sequence, relief vents, plugging and other information pertinent to completion of abandonment.

**1.03   CITED STANDARDS**

- A.    ASTM C1107 – Standard Specifications for Packaged Dry-Hydraulic Cement Grout (Nonshrink).
- B.    ASTM C940 – Standard Test Method for Expansion and Bleeding of Freshly Mixed Grouts for Preplaced - Aggregate Concrete in the Laboratory.

## **1.04 QUALITY CONTROL**

- A. The Contractor shall use an adequate number of skilled workmen who are thoroughly trained and experienced in the necessary crafts to perform the work, and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

## **PART 2 PRODUCTS**

### **2.01 PLUGS**

- A. Grout Plugs: Cement-based dry-pack grout conforming to ASTM C1107, Grade B or C.
- B. Manufactured Plug: Commercially available plug or cap specifically designed and manufactured to be used with pipe being abandoned.

### **2.02 FLOWABLE FILL**

- A. Unconfined compressive strength: minimum 75 psi and maximum 150 psi at 56 days as determined based on an average of three tests for same placement. Present at least three acceptable strength tests for proposed mix design in the abandonment plan.
- B. Placement characteristics: self-leveling.
- C. Shrinkage characteristics: non-shrink.
- D. Water bleeding for fill to be placed by grouting method: not to exceed 2 percent according to ASTM C940.
- E. Minimum wet density: 90 pcf.

## **PART 3 EXECUTION**

### **3.01 PIPE ABANDONMENT**

- A. Locate the exact location of the existing leachate collection pipe during construction of leachate collection trench along the east side. The existing pipe is anticipated to cross the designed leachate collection system at Station 13+00 of Section D. The existing pipe is a 12-in diameter

corrugated metal pipe. The top of existing pipe is anticipated to be at elevation 783 ft.

- B. Inform the CQA Consultant minimum 24 hours before execution of pipe abandonment.
- C. Cut the existing pipe in the new leachate collection trench and plug downstream end in the existing surface impoundment area and plug the upstream end in the new leachate collection trench in a manner approved by the CQA Consultant. Note that the portion of the pipe penetration towards the landfill will not be abandoned and will be allowed to drain into the new leachate collection trench.
- D. Methane gas accumulation is possible within the existing pipe. The Contractor should manage conditions within and in the vicinity of the pipe to prevent sparks that maybe generated in cutting the existing pipe.
- E. Mix flowable fill in automated batch plant and deliver it to the site in ready-mix trucks. Performance additives may be added at placement site if required by mix design.
- F. Use concrete or grout pumps capable of continuous delivery at planned placement rate.
- G. Abandon the existing leachate collection pipe by filling completely with flowable fill. No air pockets are allowed in the pipe.
- H. Have filling operation performed by experienced crews with equipment to monitor density of flowable fill and to control pressure.
- I. Pump flowable fill through bulkheads constructed for placement of two 2-inch PVC pipes or use other suitable construction methods to contain flowable fill in the existing pipe. These pipes will act as injection points or vents for placement of flowable fill.
- J. Place flowable fill under pressure flow conditions into properly vented open system until flowable fill emerges from relief vent pipes. Pump flowable fill with sufficient pressure to overcome friction and to fill pipe from downstream end to upstream end.

- K. Clean inside surface of the existing pipe at least 12 inches from both ends to achieve firm bond and seal grout plug or manufactured plug. When using grout plug, place temporary plug or bulkhead approximately 12 inches inside the pipe. Fill the pipe ends completely with dry-pack grout mixture.
- L. When using manufactured plug or cap, install fitting as recommended by manufacturer's instructions to form water tight seal.
- M. Collect and dispose of excess flowable fill material and other debris in the designated refuse area.

**END OF SECTION**

# **DIVISION 03-CONCRETE**

## **SECTION 03010**

### **COMMON WORK RESULTS FOR CONCRETE**

#### **PART 1 GENERAL**

##### **1.01 GENERAL CONDITIONS**

- A. The General Conditions apply to all work of this specification, which shall be done as shown on the plans and shall be properly coordinated with work in other Specifications.
- B. The drawings and these specifications are complementary to each other; what is called for by one shall be as binding as if called for by both. If there is any conflict between what is shown on the drawings and what is written in the specifications, the details described on the drawings shall take precedence and the Contractor shall communicate the conflicts to the CQA Consultant in a timely manner.
- C. Safety
  - 1. The Contractor shall be familiar with, and shall at all times conform to, the regulations of the “*OSHA General Industry Occupational Safety and Health Standards*,” “*OSHA Safety and Health Regulations for Construction*,” and other applicable state and municipal standards and regulations.

##### **1.02 REFERENCED SECTIONS**

- A. Related Sections are listed below:
  - 1. SECTION 01300 – SUBMITTAL PROCEDURES
- B. All concrete work shall conform to the requirements of the following standard specifications, of the latest revisions, as applicable:
  - 1. ACI Building Code
  - 2. ASTM C31 – Standard Practice for Making and Curing Concrete Test Specimens in the Field

3. ASTM C39 – Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens
4. ASTM C42 – Standard Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete
5. ASTM C143 – Standard Test Method for Slump of Hydraulic-Cement Concrete
6. ASTM C172 – Standard Practice for Sampling Freshly Mixed Concrete

### **1.03 CITED STANDARDS**

- A. Standards listed as “Reference Standards” in the various sections of these contract documents are hereby incorporated into these specifications by reference.
- B. Referenced documents shall include all revisions, amendments, supplements, or addenda issued on or before the date of advertising for bids.

### **1.04 NOTED RESTRICTIONS – NONE**

### **1.05 QUALITY CONTROL**

- A. Any change in configuration or design of the concrete foundations or structural elements which is required to accommodate any construction procedure or operation shall be done only on approval of, and at no additional cost to the Lead PRP.
- B. The Contractor shall accompany any request for a design change in the concrete work with design calculations, prepared by a qualified registered professional Structural Engineer, which shall show the effect of the proposed changes on the elements to be revised and on all supporting elements.
- C. The Contractor shall adhere to any applicable part of the specifications in this division as it relates to the work to be done.

### **1.06 SUBMITTALS**

- A. The Contractor shall submit shop drawings in accordance with Section 01300 Submittal Procedures.
- B. The Contractor shall submit manufacturer's catalog data and descriptive literature for form ties, spreaders, corner formers, form coatings and curing compound, bond breakers, joint sealant, backing rod, joint filler, epoxy bonding compound, and color additive.

## **PART 2 PRODUCTS**

### **2.01 GENERAL**

- A. All concrete, grout, and all ingredients including water shall be as approved by the CQA Consultant.
- B. Except as otherwise specified, concrete shall be composed of Portland cement, fine aggregate, coarse aggregate, and water so proportioned and mixed as to produce a plastic, workable mixture in accordance with all requirements of these Specifications and suitable to the specific conditions of placement. The proportions of materials shall be such as to secure the lowest water/cement ratio which is consistent with good workability, a plastic, cohesive mixture, and one which is within the specified slump range. The proportion of fine and coarse aggregate shall be such as not to produce harshness in placing or honeycombing in the structures.

## **PART 3 EXECUTION**

### **3.01 PREPARATION**

- A. Workmanship and Methods
  - 1. Concrete work, including detailing of reinforcing, shall be in accordance with the best standard practices and as set forth in the ACI Building Code, Manuals, and Recommended Practices.
  - 2. All concrete materials shall be so delivered, stored, and handled as to prevent damage to the materials and the inclusion of foreign substances. Packaged materials shall be delivered and stored in original containers until ready for use. Material



containers or materials showing evidence of water or other damage shall be rejected.

### **3.02 INSTALLATION**

#### **A. Watertightness of Concrete Work**

1. It is the intent of this Specification to secure for every part of the work concrete and grout of homogeneous structure, which when hardened will have the required strength, watertightness, and resistance to weathering.
2. It is recognized that some surface hairline cracks and crazing will develop in the concrete surfaces. Construction, contraction, and expansion joints have been positioned in structures, and curing methods specified, for the purpose of reducing the number and size of these expected cracks, due to the normal expansion and contraction expected from the specified concrete mixes. Class A concrete shall be watertight. Cracks which develop in walls or slabs shall be repaired. Cracks which show any signs of leakage shall be repaired until all leakage is stopped.
3. Visible cracks, other than hairline cracks and crazing, in the following areas shall be pressure grouted with low viscosity epoxy as specified herein as Epoxy Injection System: walls and overhead slabs of passageways or occupied spaces, the outside of which are exposed to weather or may be washed down and are not specified to receive a separate waterproof membrane; and other similar surfaces not specified to receive a separate waterproof membrane.
4. Walls or slabs, as above, that leak or sweat because of porosity or cracks too small for successful pressure grouting, shall be sealed on the water or weather side by coatings of a surface sealant system, as specified elsewhere herein.
5. Grouting or sealing as specified above shall be continued until the structure is watertight and shall remain watertight for not

less than one year after final acceptance or date of final repair, whichever occurs later in time.

B. Joints and Bonding

1. As far as practicable the concrete work shall be constructed as a monolith. The locations of contraction, construction, and other joints are indicated on the Drawings or specified herein. Where not specified or indicated otherwise, all slabs and walls shall have construction joints at intervals not greater than 30 feet. There shall not be less than 14 days between placement of concrete in adjacent concrete wall placements.
2. Concrete for slabs shall be placed in a checker board pattern with not less than 14 days between placement of concrete in adjacent concrete slab placements. In order to preserve the strength and watertightness of the structures, no other joints shall be made except as the Lead PRP may authorize. At construction joints, the concrete in place shall be thoroughly cleaned of laitance, grease, oil, mud, dirt, curing compounds, mortar droppings, or other objectionable matter by means of heavy sandblasting, after which the surfaces shall be washed just prior to the succeeding concrete placement. Immediately prior to resuming concrete placing operations, a bed of grout not less than 1/2 inch in thickness nor more than 1 inch in thickness shall be thoroughly spread over the horizontal joint surfaces.
3. Keyways in joints shall be provided as indicated on the Drawings. Material for keyways shall be steel, plastic or lumber treated with form release coating, applied in accordance with the manufacturer's published instructions.
4. Construction joints shall be washed free of sawdust, chips, and other debris after forms are built and immediately before the concrete placement. Should formwork confine sawdust, chips, or other loose matter in such manner that it is impossible to remove them by flushing with water, a vacuum cleaner shall be used for their removal, after which the cleaned surfaces shall be

flushed with water. A cleanout hole shall be provided at the base of each wall and column for inspection and cleaning.

5. Expansion, contraction, and construction joints shall be constructed where and as indicated on the Drawings. Waterstops, expansion joint material, synthetic rubber sealing compound, and other similar materials, shall be as specified elsewhere herein.
6. The Contractor shall prepare a test panel showing horizontal and vertical joints proposed for the project for review by the CQA Consultant.
7. The Contractor shall schedule the placing of concrete in such a manner as to complete any single placing operation to a construction, contraction, or expansion joint. Special care shall be taken to insure that concrete is well consolidated around and against waterstops and that waterstops are secured in the proper position.
8. In any case where it is necessary to repair concrete by bonding mortar or new concrete to concrete which has reached its initial set, the surface of the set concrete shall first be coated with epoxy bonding agent.

C. Measurements of Materials

1. Materials shall be measured by weighing, except as otherwise specified or where other methods are specifically authorized in writing by the Lead PRP. The apparatus provided for weighing the aggregates and cement shall be suitably designed and constructed for this purpose. Cement shall be weighed separately. The accuracy of all weighing devices shall be such that successive quantities of the individual item can be measured to within 1 percent of the desired amount of that item. Cement in unbroken standard packages (sack) need not be weighed, but bulk cement and fractional packages shall be weighed. The mixing water shall be measured by volume or by weight. The water measuring device shall be capable of control of water quantities to accuracy of 1 percent of the desired

amount. All measuring or weighing devices shall be subject to review and acceptance by the CQA Consultant, and shall bear a valid seal of the Sealer of Weights and Measures having jurisdiction.

**D. Concrete Proportions and Consistency**

1. The concrete shall be of such consistency and composition that it can be worked readily into the corners and angles of the forms and around the reinforcement without excessive vibration and without permitting the materials to segregate or free water to collect on the surface.
2. The Contractor shall prevent unnecessary or haphazard changes in consistency of the concrete. Aggregate shall be obtained from a source which shall provide uniform quality, moisture content, and grading during any single day's operation. Aggregate shall be delivered to the mixing site and handled in such a manner that variations in moisture content will not interfere with the steady production of concrete of the specified degree of uniformity and slump.
3. The concrete mix water to cement ratio, minimum cement content, and slump range shall conform to the values specified in Table A below.

TABLE A				
Type	Max. W/C ratio	Min. Cement Factor	28-day Strength	Max. Slump (in)
Class A	0.45	6	4000 psi	3 ± 1
Class C	0.59	5	2800 psi	3 ± 1

4. The Contractor shall control and adjust the concrete batch weights so as to secure the maximum yield, yet at all times the Contractor shall maintain the proportions of the concrete mix within the specified limits.
5. If it is required, in the opinion of the CQA Consultant, the mixture shall be modified within the limits set forth in these Specifications.

E. Concrete Mixes

1. Prior to placement of concrete, the Contractor shall submit full details, including mix design calculations for the concrete mix he proposes to use for each class of concrete. The concrete mix shall be proportioned based on the required average compressive strength  $f'_{cr}$  defined in the following subsection.
2. After acceptance, the Contractor shall have trial batches of the accepted Class A concrete mix designs prepared by a testing laboratory acceptable to the Lead PRP. The trial batches shall be prepared using the specified cement and aggregates proposed to be used for the Work. The trial batch shall be of sufficient quantity to determine slump, workability, consistency and finishing characteristics, and to provide sufficient test cylinders. Test cylinders shall be 6 inch diameter by 12 inch long and prepared in accordance with ASTM C 31 for the tests specified hereinafter. Data shall be submitted for each of the test cylinders. The data shall identify the mix and slump for each of the test cylinders. Slump shall be determined in accordance with ASTM C 143.
3. Eight test cylinders shall be compression tested in accordance with ASTM C 39. Four test cylinders shall be tested at 7 days and four at 28 days. A ratio between 7 day and 28 day strength will be established for the mix and the 7 day strength may be taken as a satisfactory indication of the 28 day strength provided the effects on the concrete of temperature and humidity between the 7<sup>th</sup> and 28<sup>th</sup> day are taken into account. The average compressive strength of the four test cylinders tested at 28 days shall be equal to or greater than the required

average compressive strength  $f_{cr}$  on which the concrete mix design is based.

4. If the trial batch tests do not meet the Specifications for slump, strength, workability, consistency, and finishing, the concrete mix design proportions and, if necessary, source of aggregate shall be changed and additional trial batches and tests shall be made until an acceptable trial batch is produced that meets the Specifications.
5. All test batches and tests required to establish trial batches and acceptability of materials shall be paid for by the Contractor.
6. After acceptance, the mixes shall not be changed without reacceptance by the CQA Consultant, except that at all times the batching of water shall be adjusted to compensate for the free moisture content of the fine aggregate. Satisfactory means shall be provided at the batching plant for checking the moisture content of the fine aggregate. The details of concrete mixes submitted for review shall include information on the correction of the batching for varying moisture contents of the fine aggregate.
7. If there is a change in the aggregate source, or if there is a change in aggregate quality from the same source, the Contractor shall submit a new set of design mixes covering each class of concrete, and a new trial batch and test program shall be undertaken as hereinbefore specified. Each new trial batch and test program shall be at the expense of the Contractor.

F. Required Average Compressive Strength

1. The required average compressive strength,  $f_{cr}$  for the selection of concrete proportion for the mix design, for each class of concrete, shall be determined using the calculated standard deviation and its corresponding specified compressive strength  $f_c$ , in accordance with ACI 318, Part 3, Chapter 5.
2. Where the Contractor has a test record of at least 30 consecutive tests that span a period of not less than 45 calendar days, a

standard deviation shall be established as described in ACI 318, Part 3, Chapter 5 and as modified herein. Test records from which the standard deviation is calculated shall represent materials, quality control procedures, and conditions similar to the materials, quality control procedures, and conditions expected to apply in the preparation of concrete for the Work. Changes in materials and proportions within the test records shall have been more restricted than those for the Work. The specified compressive strength  $f'_c$  of concrete used in the test records shall be within 1,000 psi of that specified for the Work.

3. The Contractor shall include the test records with the mix design submittal.
4. Where the Contractor does not have a test record for calculation of standard deviation meeting requirements specified herein, the required average compressive strength  $f'_{cr}$  shall be determined from Table B.

TABLE B

Specified Compress Strength $f'_c$ (pound per square inch)	Required Average Compressive Strength $f'_{cr}$ (pound per square inch)
Less than 3,000	$f'_c + 1,000$
3,000 to 5,000	$f'_c + 1,200$
Over 5,000	$f'_c + 1,400$

G. Enforcement of Strength Requirement

1. Concrete is expected to reach a higher compressive strength than that which is indicated in Table B as the specified compressive strength  $f'_c$ . The strength level of the concrete will be considered acceptable if all of the following conditions are satisfied.

- a. The averages of all sets of three consecutive strength test results shall be greater or equal to specified compressive strength  $f'_c$ .
- b. No individual strength test (average of two cylinders) shall fall below specified compressive strength  $f'_c$  by more than 500 psi.
- c. Whenever one, or both, of the two conditions stated above is not satisfied, the Contractor shall provide additional curing of the affected portion followed by cores taken in accordance with ASTM C 42 and ACI 318. If the additional curing does not bring the average of three cores taken in the affected area to at least the specified compressive strength  $f'_c$ , all concrete in the affected area shall be designated as defective. The Lead PRP may require the Contractor to strengthen the defective concrete by means of additional concrete, additional reinforcing steel, or replacement of the defective concrete, all at the Contractor's expense.

### **3.03 TESTING OF CONCRETE**

- A. During the progress of construction, the Contractor will have tests made to determine whether the concrete, as being produced, complies with the requirements specified herein. These tests shall be made in accordance with ASTM C 31, ASTM C 39, and ASTM C 172. Test cylinders will be made and delivered to the laboratory by the Contractor and the testing expense will be borne by the Contractor.
- B. See paragraph J of Section 03090 – 1.05 for more information on strength testing.
- C. The Contractor shall test the slump of concrete using a slump cone in accordance with the requirements of ASTM C 143. The Contractor shall provide the test equipment. Concrete that does not meet the Specification requirements as to slump shall not be used and shall be removed from the job. The Contractor shall test the slump at the beginning of each placement, as often as necessary to keep the slump



within the specified range, and when requested to do so by the Lead PRP.

The Contractor shall make provisions for and furnish all concrete for the test specimens. The Contractor shall be responsible for the care of and providing curing conditions for the test specimens in accordance with ASTM C 31.

**END OF SECTION**

## **SECTION 03020**

### **WATERTIGHTNESS TEST FOR CONCRETE STRUCTURES**

#### **PART 1 GENERAL**

##### **1.01 SECTION INCLUDES**

- A. This section describes the Contractor's responsibilities regarding furnishing of all labor, materials and incidentals required to perform watertightness testing of liquid-containing structures as listed herein and all retesting until the structures meet the requirements as specified herein.

##### **1.02 RELATED SECTIONS**

- A. All liquid retaining structures incorporated as part of these specifications, primarily including materials and equipment described in the following sections:
  - 1. Division 3 – Concrete
  - 2. Division 4 – Process Integration
  - 3. Division 5 – Process Gas & Liquid Handling, PURIFICATION, And Storage Equipment

##### **1.03 CITED STANDARDS**

- A. All work specified herein shall conform to the following, or latest revisions of as applicable:
  - 1. AWWA DI100- Welded Steel Tanks for Water Storage.
  - 2. ACI 350.1 - Tightness Testing of Environmental Engineering Concrete Structures.

##### **1.04 NOTED RESTRICTIONS - NONE**

##### **1.05 QUALITY CONTROL**

- A. The Contractor shall coordinate timing and procedures for obtaining testing water and structure testing with the Lead PRP's Representative well in advance of the actual testing.

**B. Water Source and Disposal**

1. Water shall be the type as designated by the Lead PRP's Representative, and obtained at a time, rate of flow, and location approved by the Lead PRP's Representative. All labor, equipment and materials shall be supplied by the Contractor.
2. It shall be the Contractor's responsibility to collect and dispose of test water using methods, facilities, and proper manifestation as approved of by the Lead PRP and Lead PRP's Representative.

**1.06 SUBMITTALS**

- A. The Contractor shall submit the results of each watertightness test of each structure. The submittal format shall be similar to that shown in Figure A attached to end of this Section.

**PART 2 PRODUCTS – NOT USED**

**PART 3 EXECUTION**

**3.01 PREPARATION**

- A. The Contractor shall thoroughly clean the structure to be tested of dirt, mud and construction debris prior to initiating watertightness tests. The floor and sumps (as applicable) shall be flushed with water to provide a clean surface, ready for testing.
- B. The Contractor shall inspect the structure to be tested for potential leakage paths such as cracks, voids, etc and repair such paths in compliance with the provisions specified herein or as approved by the Lead PRP's Representative.
- C. The Contractor shall confirm adequacy of seals around gates and valves and reset or seal as approved by the Lead PRP's Representative. Estimates of gate or valve leakage will not be allowed as adjustments to the measured tank or structure leakage.
- D. Inlet and outlet pipes not required to be operational for the tests may be temporarily sealed or bulk headed prior to testing.

### **3.02 INSTALLATION - NOT USED**

### **3.03 TESTING**

#### **A. Conditions of Testing**

1. Perform tightness testing in conformance with Chapter 2 of ACI 350.1 (hydrostatic test).
2. Do not begin initial filling of concrete structures until all concrete elements of the structure have attained the design compressive strength of the concrete, nor less than 14 days after all concrete walls or base slabs have been placed.
3. Initial filling rate, water depth and waiting period shall conform to the requirements of ACI 350.1.

#### **B. Testing Procedures**

1. Duration of the test shall not be less than that required for a drop in the water surface of 3/8-in based on the calculated maximum allowable leakage rate but need not exceed 5 days.
2. Loss of volume measurements shall be taken at 24 hour intervals. The loss of volume is usually determined by measuring the drop in water surface elevation and computing the change in volume of the contained water. Measure water surface elevation at no less than two locations at 180 degrees apart and preferably at four locations 90 degrees apart. Record water temperature 18-in below the water surface when taking the first and last sets of measurements.

#### **C. Reporting Requirements**

1. Submit to the Lead PRP's Representative watertightness test results for each structure tested using the form shown in Figure A or a similar form showing the necessary information and approved by Lead PRP's Representative.
2. Notify the Lead PRP's Representative of the scheduling of tests 3 working days prior to the tests. The Lead PRP's

Representative may monitor any watertightness testing performed on the structures.

### **3.04 ACCEPTANCE OF RESULTS**

- A. The following conditions shall be considered as NOT meeting the criteria for acceptance regardless of the actual loss of water volume from the structure.
  - 1. Ground water leakage into the structure.
  - 2. Structures which exhibit water flowing from the tank or from beneath the foundation (except for underdrain systems).
  - 3. Structures on which moisture can be picked up by a dry hand from the exterior surface.
- B. Attached at the end of this section (for use by the Contractor) is the following:
  - 1. FIGURE A – WATERTIGHTNESS TEST REPORT

### **3.05 REPAIRS AND RETESTING**

- A. Structures failing the watertightness test and not exhibiting visible leakage may be retested after an additional stabilization period of not less than 3 days.
- B. Repair structures which fail the watertightness test and structures showing visible leakage in compliance with the provisions specified herein or as approved by the Lead PRP's Representative.
- C. Repairs and retesting of tanks shall be accomplished at no additional cost to the Lead PRP.

## FIGURE A – WATERTIGHTNESS TEST REPORT

PROJECT \_\_\_\_\_

STRUCTURE \_\_\_\_\_

\* Attach a sketch showing a plan of the structure and measurement locations.

TEST DATE(S) \_\_\_\_\_

SUBMITTED  
BY \_\_\_\_\_

### INITIAL DATA

Initial Water Temperature \_\_\_\_\_ °F

Allowable loss of water volume (%) in 24  
hrs. \_\_\_\_\_ %

### FINAL DATA

Final Water Temperature (at conclusion of  
test) \_\_\_\_\_ °F

Measured loss of water volume (%) in 24  
hrs. \_\_\_\_\_ %

Date	Time	TEST READINGS (WATER LEVEL)				Initial s
		Location 1	Location 2	Location 3	Location 4	

1						
2						
3						
4						
5						
	Change in Level					
	Correction for					
	Evaporation					
Corrected change in level						
(CL) =						

Notes:

END OF SECTION

**SECTION 03030**  
**CONCRETE FORMING**

**PART 1      GENERAL**

**1.01   SECTION INCLUDES**

- A.      This section includes a description of how the Contractor shall address the construction practices that relate to concrete forming.

**1.02   RELATED SECTIONS**

- A.      Section 03090 – Cast-In-Place Concrete

**1.03   CITED STANDARDS**

- A.      All concrete forming shall conform to the requirements of the following standard specifications, of the latest revisions, as applicable:
  - 1.      ACI 117-10 – Specification for Tolerances for Concrete Construction and Materials
  - 2.      ACI International 347 - Guide to Formwork for Concrete
  - 3.      APA PS1 (1995) - Construction and Industrial Plywood (APA V995)
  - 4.      ASTM C31/C31M-06 - Standard Practice for Making and Curing Concrete Test Specimens in the Field
  - 5.      ASTM C39/C39M-05e1 - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens

**1.04   NOTED RESTRICTIONS**

- A.      Failure of any supporting surface either due to surface texture, deflection or form collapse shall be the responsibility of the Contractor.

**1.05   QUALITY CONTROL**

- A.      Forming systems shall be performed by manufacturers with a minimum of 5 years of experience. Forms for all exposed concrete shall be carefully built to produce the contour and design indicated. Care shall



be taken to assure that all form joints are truly vertical or horizontal. No sloping joints will be accepted.

- B. Formwork shall be designed as a complete system with consideration given to the effects of cementitious materials and mixture additives such as fly ash, cement type, plasticizers, accelerators, retarders, air entrainment, and others. The adequacy of formwork design and construction shall be monitored prior to and during concrete placement.
- C. Formwork shall be designed for anticipated live and dead loads, and shall comply with the tolerances specified in Section 03090 – Cast-In-Place Concrete.

## **1.06 SUBMITTALS**

- A. The Contractor shall submit manufacturer's catalog data and descriptive literature for form ties, spreaders, corner formers, form coatings and curing compound, bond breakers, joint sealant, backing rod, joint filler, epoxy bonding compound, and color additive to the Lead PRP's Representative.
- B. The shop drawings and data submitted shall include the type, size, quantity, and strength of all materials of which the forms are made, the plan for jointing of facing panels, details affecting the appearance, and the assumed design values and loading conditions.
- C. Manufacturer's literature shall be submitted for plywood, concrete form hard board, form accessories, prefabricated forms, form coating, and form-lining materials.

## **PART 2 PRODUCTS**

### **2.01 FORMS AND FORM LINERS**

- A. All forms and form liners shall be fabricated as defined in ACI 347. Forms shall conform to the shape, lines, grades and dimensions of the concrete as called for on the drawings. All lumber used for forms shall be thoroughly cleaned and free from dirt, debris, concrete, etc. and treated with an approved form oil. Lumber used in forms for exposed surfaces shall be dressed to a uniform thickness and shall be free from loose knots or other defects.

- B. For a smooth, hard, and dense finish, a sufficient number of forms shall be provided so that the work may be completed rapidly and present a uniform appearance in form patterns and finish.
- C. For unexposed surfaces and rough work, undressed lumber free of nails and clean of hardened concrete or other foreign material may be used. Lumber once used in forms shall have nails withdrawn, and surfaces to be in contact with concrete shall be thoroughly cleaned before being used again.
- D. Form sheathing for exposed surfaces may be composed of tongue and groove lumber, shiplap, plywood, concrete form board, or steel. Steel lining on wood lagging will not be permitted. Tongue and groove shiplap when used shall conform to the American Lumber Standards for No. 2 boards.
- E. Forms and form liners for this project shall be fabricated with a Class A or B Finish. Plywood used for sheathing or lining shall be Grade B-B exterior or better as described in the Commercial Standards of the Douglas Fir Plywood Association. The forms used shall produce a concrete surface with "abrupt" irregularities less than ¼ in. and gradual irregularities less than ½ in. in 5 ft.
- F. Forms shall be sufficiently tight to prevent leakage of mortar. They shall be properly braced or tied together so as to maintain the desired position and shape during and after placing concrete and so they will not tremble or distort in a high wind.

## **2.02 FORM COATINGS**

- A. Forms for exposed or painted surfaces shall be coated with approved form oil before the form or reinforcement is placed in final position. Forms for unexposed surfaces may be wet with water in lieu of coating immediately before placing concrete in hot weather.
- B. Surplus coating on form surfaces and coating on reinforcing steel and construction joints shall be removed before placing concrete.

## **2.03 KEYWAYS AND INSERTS (WHERE NECESSARY)**

- A. Material for keyways shall be steel, plastic, or lumber treated with form coating, applied according to label directions. Pipes, anchor bolts, steps, reglets, castings, and other inserts shall be encased in the concrete. Dovetail anchors or ties shall be used in conjunction with the slots or inserts for the various materials as may be necessary for the required work.

### **PART 3 EXECUTION**

#### **3.01 PREPARATION AND INSTALLATION**

- A. Form Construction
  - 1. The Contractor shall continuously monitor the alignment and stability of the forms during all phases to assure the finished product will meet the required surface class (or classes) specified in Part 2 of this section above.
  - 2. When forms for continuous surfaces are placed in successive units, care shall be taken to fit the forms over the completed surface to obtain accurate alignment of the surface and to prevent leakage of mortar. Forms shall not be re-used if there is any evidence of defects which would impair the quality of the resulting concrete surface. All surfaces of used forms shall be cleaned of mortar and any other foreign material before reuse.
- B. Chamfering
  - 1. Where not otherwise indicated on the Drawings, all external angles of walkways, slabs, walls, beams, columns, and openings shall have a  $\frac{3}{4}$ " bevel formed by utilizing a true dimensioned wood or solid plastic chamfer strip and external angles of walkways, walls, and slabs at expansion, contraction, and construction joints shall be a  $\frac{1}{2}$ " bevel formed by utilizing a true dimensioned wood or solid plastic chamfer strip. Reentrant angles may be left square. Level strips shall be installed at the top of all wall concrete placements to maintain a true line at all horizontal construction joints.

2. Chamfered joints shall not be permitted where earth or rock fill is placed in contact with concrete surfaces. Chamfered joints shall be terminated 12" (30 cm) outside the limit of the earth or rock fill so that the end of the chamfers will be clearly visible.

C. Bracing and Alignment of Forms

1. All formwork shall be securely braced, supported, tied down, or otherwise held in place to prevent any movement of formwork.
2. When a second lift is placed on hardened concrete, special precautions shall be taken in the form work at the top of the old lift and bottom of the new lift to prevent spreading, vertical or horizontal displacement of forms; and to prevent grout "bleeding" on finished concrete surfaces. Pipe stubs, anchor bolts, and other embedded items shall be set in the forms where required.
3. No concrete shall be placed until all forms have been thoroughly checked by the Contractor for alignment, level, strength, and to assure accurate location of all mechanical and electrical inserts or other embedded items. All cracks, openings, or offsets at joints in the formwork which are 1/16 inch or larger shall be closed by tightening the forms or by filling with an acceptable crack filler.

D. Tolerances

1. It shall be the responsibility of the Contractor to comply with the intent of these specifications, but it is also recognized that there will be occasions when some deviation will occur or be required. It shall therefore be agreed that the maximum deviation from true line and grade shall not exceed the tolerances listed below at the time of acceptance of the project.
2. All tolerances shall comply with ACI 117-10. All slabs shall be uniformly sloped to drain when a slope is indicated. Slabs which are indicated to be level shall have a maximum deviation of  $\frac{1}{8}$ " in 10 feet without any apparent changes in grade.

3. All inserts shall be set to the tolerances required for the proper installation and operation of the equipment or systems to which the insert pertains. The following shall be considered maximum tolerances.

Item	Max Tolerance (in)
Sleeves and inserts	+/- 1/8"
Projected ends of anchor bolts	+/- 1/4"
Anchor bolt setting	+/- 1/16"

E. Removal of Forms

1. The Contractor shall remove forms in such a manner as to insure the complete safety of the structure. All forms supporting concrete and shoring shall remain in place as follows:

Form Type	Duration Period in Place
Vertical Forms	24 hours min
Sides of footings	24 hours min
Vertical sides of beams, girders, etc.	48 hours min
Slabs, beams, and girders	Until concrete reaches the specified strength or until shoring is installed
Shoring for slabs, beams, girders	Until concrete reaches the specified strength

Wall bracing	Until concrete beams and slabs  laterally supporting the wall reaches  the specified strength
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2. No form or form support shall be removed from the formed surface for at least 24 hours. In case the Contractor shall remove any form before the above conditions have been met, the concrete elements may be condemned even though there is no apparent defect.
3. Factors related to form removal include ambient temperature, concrete lift heights, the type and amount of concrete admixture, and type and amount of cementitious material in the concrete. The Contractor is responsible for considering all of the applicable factors and for leaving the forms in place until it is safe to remove them.
4. Where forms support more than one element, the forms shall not be removed until the form removal criteria are met by all supported elements.

F. Control Cylinders

1. Evidence that the concrete has gained sufficient strength to permit removal of forms shall be determined by tests on control cylinders.
2. Control cylinders shall be stored in the structure or as near the structure as possible so they receive the same curing conditions and protection methods as given to the portions of the structure they represent.
3. Control cylinders shall be removed from the molds at an age of no more than 24 hours. All control cylinders shall be in accordance with ASTM C 31/C 31M and ASTM C 39/C 39M.

G. Form Ties

1. After the forms and the tapered ties are removed from the wall, tapered tie holes shall be plugged. Tie holes shall be heavy blasted, cleaned, and then shall have a rubber plug driven into each of the tapered tie holes with a steel rod. The steel rod shall be located in a cylindrical recess, made in the plug, during driving. At no time shall plugs be driven on the flat area outside the cylindrical recess. The rubber plug shall be sized so that after it is driven into the tapered tie hole, the plug will be located near the center of the wall.
2. After installing plugs in the tapered tie holes, the tie holes shall be coated with epoxy bonding agent and filled with dry-pack mortar with a dry consistency and with a mix of one part of Portland cement to one part of plaster sand. The amount of water to be added to the cement-sand mix shall be such that the mortar can be driven into the holes and will compact properly. The dry-pack mortar shall be heavily compacted in the holes and shall be placed in layers with a thickness not exceeding the tie hole diameter. Admixtures or additives shall not be used in the dry-pack mortar.
3. The wall surfaces in the area of the dry-packed tie holes shall be covered with a minimum of 10 mils of epoxy gel. The epoxy gel coating on the wall surface shall extend a minimum of 2 inches past the dry-pack mortar filled tie hole. The finish surfaces shall be free from sand streaks or other voids.

**3.02 TESTING**

- A. Forms and embedded items shall be inspected in sufficient time prior to each concrete placement by the Contractor. The results of each inspection shall be reported to the Lead PRP's Representative.
- B. Watertightness shall be as described in Section 03020 - Watertightness Test For Concrete Structures.

**END OF SECTION**

**SECTION 03040**  
**CONCRETE ACCESSORIES**

**PART 1      GENERAL**

**1.01   SECTION INCLUDES:**

- A.      This section includes a description of how the Contractor shall proceed to furnish all material, equipment, labor, services, etc., to complete and install the following (as applicable):
  - 1.      Waterstops
  - 2.      Preformed synthetic sponge rubber expansion joint material.
  - 3.      Preformed bituminous fiber expansion joint material.
  - 4.      Expanded polystyrene joint filler.
  - 5.      Hardboard.

**1.02   RELATED SECTIONS**

- A.      Section 03050 – Waterstops

**1.03   CITED STANDARDS**

- A.      All concrete accessories shall conform to the requirements of the following standard specifications, of the latest revisions, as applicable:
  - 1.      ASTM A 167 - Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, And Strip.
  - 2.      ASTM C 203 - Test Methods for Breaking Load and Flexural Properties of Block-Type Thermal Insulation.
  - 3.      ASTM D 570 - Test Method for Water Absorption of Plastics.
  - 4.      ASTM D 624 - Test Method for Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomers.
  - 5.      ASTM D 638 - Test Method for Tensile Properties of Plastics.



6. ASTM D 746 - Test Method for Brittleness Temperature of Plastics and Elastomers by Impact.
7. ASTM D 747 - Test Method for Apparent Bending Modulus of Plastics by Means of a Cantilever Beam.
8. ASTM D 792 - Test Methods for Density and Specific Gravity (Relative Density) of Plastics by Displacement.
9. ASTM D 2240 - Test Method for Rubber Property – Durometer Hardness.
10. FS LLL-B-810B, Building Board (Hardboard) Hard Pressed, Vegetable Fiber.
11. USACE - COE CRD-C 572 Specifications for Polyvinylchloride Waterstops

#### **1.04 NOTED RESTRICTIONS - NONE**

#### **1.05 QUALITY CONTROL**

A. Mock-ups:

1. Welding Demonstration:
  - a. Demonstrate ability to weld acceptable joints in polyvinyl chloride waterstop before installing waterstop in forms.
  - b. Quality of welded joints will be subject to acceptance of the Engineer.

#### **1.06 SUBMITTALS**

A. Product Data:

1. Submit data of complete physical properties for polyvinyl chloride waterstops.

2. Preformed Expansion Joint Material: Submit sufficient information on each type of material for review to determine conformance of material to requirements specified.
- B. Samples
1. Submit samples of polyvinyl chloride waterstops.
- C. Laboratory Test Reports
1. Submit reports indicating that average properties of polyvinyl chloride waterstops material and finish conform to requirements specified in this Section.
- D. Quality Control Submittals
1. Certificates of Compliance: Submit written certificates that polyvinyl chloride waterstops supplied on this project meet or exceed physical property requirements of current USACE CRD-C-572.
  2. Manufacturer's Instructions: Submit instructions for materials specified in this Section that are specified to be installed with such instructions.

## **PART 2 PRODUCTS**

### **2.01 POLYVINYL CHLORIDE WATERSTOPS**

- A. Polyvinyl Chloride Waterstops shall be provided by Greenstreak Plastic Product Division of Western Textile Products Company or an equal approved by the Lead PRP's Representative.
- B. The Contractor shall provide waterstops manufactured from virgin polyvinyl chloride plastic compound that does not contain any scrap or reclaimed material.
- C. Additional details pertaining to waterstops shall be as described in 03050 Waterstops.

**2.02 STAINLESS STEEL PLATE WATERSTOPS (IF NECESSARY)**

- A. Stainless Steel waterstops shall be non-expansion joint type and shall be provided as necessary in accordance with ASTM A167 Type 316L.

**2.03 EXPANDED POLYSTYRENE JOINT FILLER (IF NECESSARY)**

- A. Commercially available polystyrene board, having following minimum characteristics:
  - 1. Flexural Strength, Minimum: 35 pounds per square inch in accordance with ASTM C 203.
- B. Compressive Yield Strength: Between 16 and 40 pounds per square inch, at 5 percent compression.

**2.04 HARDBOARD (IF NECESSARY)**

- A. Where hardboard is necessary, it shall be 1/8-inch minimum thickness, conforming to FS LLL-B-810, any type.

**2.05 PREFORMED EXPANSION JOINT MATERIAL (IF NECESSARY)**

- A. Preformed expansion joint material shall be synthetic sponge rubber or bituminous fiber types.
- B. Sponge Rubber Type Expansion Joints:
  - 1. Manufacturer shall be one of the following or equal:
    - a. Tammstech, Inc., Cementone.
    - b. W.R. Grace and Company, Cementone Code 3329
    - c. Burke Concrete Accessories Inc., Neoprene Sponge Rubber Expansion Joint.
- C. Bituminous Fiber Type:
  - 1. Manufacturer shall be one of the following or equal:
    - a. Tammstech, Inc., Hornboard/fiber.

- b. Burke Concrete Accessories Inc., Fiber Expansion Joint.
- c. W.R. Grace and Company, Cone Fiber Expansion Joint Fillers Code 1390

## **PART 3 EXECUTION**

### **3.01 PREPARATION**

- A. The Contractor shall review the manufacturer's specifications and recommendations prior to installation.

### **3.02 INSTALLATION**

- A. Waterstops, General
  - 1. Install waterstops in concrete joints where indicated on the Drawings.
  - 2. Carry waterstops in walls into lower slabs and join to waterstops in slabs with appropriate types of fittings.
  - 3. In Waterbearing Structures, provide all joints with waterstops, whether indicated on the Drawings or not.
  - 4. Provide waterstops that are continuous and accurately positioned as indicated on the Drawings.
  - 5. Hold and securely fix edges in position at intervals of not more than 24 inches so that they do not move during placing of concrete.
  - 6. Do not drive nails, screws, or other fasteners through waterstops in vicinity of construction joints.
  - 7. Use wires at not more than 24 inches on centers near outer bulbs to tie waterstops into position.
  - 8. Special clips may be used in lieu of wires, at Contractor's option.

9. Terminate waterstops 3 inches from top of finished surfaces of walls and slabs unless otherwise specified or indicated on the Drawings.
  10. Polyvinyl Chloride Waterstops:
    - a. Install waterstops so that joints are watertight.
    - b. For joints such as unions, crosses, ells, and tees, field weld with thermostatically controlled equipment recommended by the waterstop manufacturer.
    - c. Split type waterstop will not be permitted except where specifically indicated on the Drawings.
- B. Joints:
1. Construct expansion, contraction, and construction joints as indicated on the Drawings.
  2. Preformed Expansion Joint Material: Fasten expansion joint strips to concrete, masonry, or forms with adhesive. No nailing will be permitted, nor shall expansion joint strips be placed without fastening.
- C. Expanded Polystyrene Joint Filler:
1. When filler is indicated on the Drawings or specified, place filler in correct position before concrete is placed against filler.
  2. Fill holes and joints in filler with caulking to prevent entry of mortar into joint or passage of mortar or concrete from one side of joint to other.
- D. Hardboard:
1. When indicated on the Drawings, face surface of joint filler with hardboard.
  2. Other facing materials may be used provided they furnish equivalent protection.

3. Hold boards in place by nails, waterproof adhesive, or other means acceptable to the Engineer.

**END OF SECTION**

## **SECTION 03050**

### **WATERSTOPS**

#### **PART 1 GENERAL**

##### **1.01 SECTION INCLUDES**

- A. This section includes provisions for waterstops embedded in concrete and spanning control, expansion, and/or construction joints to create a continuous diaphragm to prevent fluid migration.
- B. This section also includes provisions for non-metallic waterstops for use in concrete joints subjected to chlorinated water and other waterborne chemicals.

##### **1.02 REFERENCED SECTIONS**

- A. Related Sections are listed below:
  - 1. Section 03040 – Concrete Accessories

##### **1.03 CITED STANDARDS**

- A. All waterstops shall conform to the requirements of the following standard specifications, of the latest revisions, as applicable:
  - 1. International Federal Specifications SS-S-210A "Sealing Compound for Expansion Joints"
  - 2. USACE - COE CRD-C 572 Specifications for Polyvinylchloride Waterstops
  - 3. Bureau of Reclamation: C-902

##### **1.04 NOTED RESTRICTIONS**

- A. No nails shall be driven through waterstops in the vicinity of construction joints

##### **1.05 QUALITY CONTROL**

- A. The waterstop manufacturer shall demonstrate five years (minimum) continuous of successful experience in production of waterstops.

#### **1.06 DELIVERY AND STORAGE**

- A. Materials delivered and placed in storage shall be stored off the ground and protected from moisture, dirt, and other contaminants. The waterstops shall be stored out of direct sunlight.
- B. Sealants shall be delivered in the manufacturer's original unopened containers. Sealants whose shelf life has expired shall be removed from the site.

### **PART 2 PRODUCTS**

#### **2.01 PVC WATERSTOPS**

- A. Waterstop shall be polyvinyl chloride and shall be manufactured by:
  - 1. Greenstreak Plastic Products Division of Western Textile Products Company,
  - 2. Burke Concrete Accessories Inc.;
  - 3. Kirkhill Rubber Company; Williams Products Inc.; or equal.
- B. PVC waterstops shall be extruded from an elastomeric plastic material of which the basic resin is prime virgin polyvinyl chloride. The PVC compound shall not contain any scrapped or reclaimed material or pigment whatsoever.
- C. Waterstops shall be manufactured by such a process that they will be dense, homogenous, and free from holes and other imperfections. The cross-section of the waterstop shall be uniform and symmetrical along its entire length.
- D. Performance requirements shall be as follows:



Property	Test Method	Required Limits
Water absorption	ASTM D 570	0.15% max
Tear Resistance	ASTM D 624	300 lb/in (52.5 kN/m) min.
Ultimate Elongation	ASTM D 638	350% min.
Tensile Strength	ASTM D 638	2000 psi (13.78 Mpa) min.
Low Temperature Brittleness	ASTM D 746	No Failure @ -35° F (-37° C)
Stiffness in Flexure	ASTM D 747	700 psi (4.82 Mpa) min.
Specific Gravity	ASTM D 792	1.38 max.
Hardness, Shore A	ASTM D 2240	79 $\pm$ 3
Tensile Strength after accelerated extraction	CRD-C 572	1600 psi (9.54 Mpa) min.
Elongation after accelerated extraction	CRD-C 572	300% min.
Effect of Alkalies after 7 days:  Weight Change	CRD-C 572	between -0.10% / +0.25%

Hardness Change		+/- 5 points
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## **2.02 ACCESSORIES**

- A. The Contractor shall provide factory made waterstop fabrications for all changes of direction, intersections, and transitions leaving only straight butt joint splices for the field.
- B. The Contractor shall also provide hog rings or grommets spaced at 12 inches on center along length of waterstop.
- C. For field butt splices, the Contractor shall provide Teflon coated thermostatically controlled waterstop splicing irons.

## **2.03 PREFORMED PLASTIC ADHESIVE WATERSTOPS (RECOMMENDED WHERE APPLICABLE)**

- A. Preformed plastic adhesive waterstops shall be single-component, self-sealing strip applied plastic waterstops extruded in a "rope" form between two "quick-release" papers.
- B. Preformed Plastic Adhesive Waterstops shall have an indefinite shelf life and shall contain no solvents, irritating fumes, or obnoxious odor.
- C. The waterstop shall be a single-component, self-sealing plastic adhesive type. It shall also have non-oxidizing, non-evaporating, non-expanding, non-shrinking and with water, chemical and saturated hydrogen sulfide resistant characteristics.

## **PART 3 EXECUTION**

### **3.01 PREPARATION**

- A. The Contractor shall review the manufacturer's specifications and recommendations prior to installation.

### **3.02 INSTALLATION**

- A. Field butt splices shall be heat fused welded using a Teflon coated thermostatically controlled waterstop splicing iron at approximately 380 degrees F. Follow approved manufacturer recommendations. Lapping of waterstop, use of adhesives, or solvents shall not be allowed.
- B. Center waterstop in joint and secure waterstop in correct position using hog rings or grommets spaced at 12 inches on center along the length of the waterstop and wire tie to adjacent reinforcing steel.
- C. Additional Details
  - 1. All joints such as unions, crosses, ells and tees for PVC waterstop shall be field welded with thermostatically controlled equipment recommended by the waterstop manufacturer. The Contractor shall demonstrate the ability to weld acceptable joints in the PVC waterstop before installing waterstop in the forms. Quality of welded joints will be subject to the approval of the Lead PRP's Representative.
  - 2. Exposed waterstops shall be protected during applications of form release agents to avoid being coated.
  - 3. The Contractor shall protect exposed projecting edges and ends of partially embedded waterstops from damage.
  - 4. If splices are to be used, they shall be made by certified trained personal using equipment and procedures approved by the Lead PRP's Representative.
  - 5. Waterstops in walls shall be carried into lower slabs and shall join the waterstops in the slabs with appropriate types of fittings.
  - 6. Waterstops shall be terminated 3 inches from the top of finished surfaces of walls and slabs unless otherwise specified or indicated on the Drawings.
- D. Preformed Plastic Adhesive Waterstop Installation

1. Installation for preformed plastic adhesive waterstops shall be a prime, peel, place, and pour procedure.
2. Joint surfaces shall be clean and dry before priming and just prior to placing of the sealing strips. If conditions are damp or cold, the joint surface shall be flashed with a direct flame to warm and dry the surface. The sealing strips shall be dipped in warm water to soften the material to achieve maximum bond to the concrete surface.
3. The Contractor shall strip the protective paper wrapper from one side only of the waterstop material then press waterstop material strip firmly against primed surface throughout length and width of strip.
4. The Contractor shall then join the strips together with a 1" overlap to form a continuous waterstop. The Contractor shall remove the remaining protective paper when ready to install forms and pour concrete.

### **3.03 FIELD QUALITY CONTROL**

- A. Waterstop splicing defects which are unacceptable include, but are not limited to the following:
  1. Tensile strength less than 80 percent of parent section.
  2. Misalignment of centerbulb, ribs, and end bulbs greater than 1/16 inch.
  3. Bond failure at joint deeper than 1/16 inch or 15 percent of material thickness.
  4. Misalignment that reduces waterstop cross section more than 15 percent.
  5. Visible porosity in the weld.
  6. Bubbles or inadequate bonding.

7. Visible signs of splice separation when cooled splice is bent by hand at a sharp angle.
8. Charred or burnt material.

B. Cleanup

1. The Contractor shall immediately remove all spots, smears, stains, residues, and adhesives, etc. which result from the work.
2. Upon completion of the work, the Contractor shall properly dispose of all debris, trash, containers, residue, remnants, and scraps which results from the work.

**END OF SECTION**

## **SECTION 03060**

### **WATERPROOF SEALS (LINK-SEAL)**

#### **PART 1 GENERAL**

##### **1.01 SECTION INCLUDES**

- A. This section includes the Contractor's responsibilities regarding watertight seals for all concrete penetrations for pipe and conduit.

##### **1.02 REFERENCED SECTIONS**

- A. Related Sections are shown below.
  - 1. DIVISION 4 - PROCESS INTEGRATION

##### **1.03 CITED STANDARDS - NONE**

##### **1.04 NOTED RESTRICTIONS**

- A. Link-Seal Modular Seals are specifically designed as hydrostatic and/or fire-rated seals and are not considered to be pipe supports. When appropriate, Link-Seal Modular Seals should be used with proper pipe supports on both ends.

##### **1.05 QUALITY CONTROL**

- A. Each individual link shall be conspicuously and permanently identified with the name of the manufacturer and model number. Link-Seal® Modular Seal components and systems shall be domestically manufactured at a plant with a current ISO-9001:2000 registration. Copy of ISO-9001:2000 registrations shall be a submittal item.

#### **PART 2 PRODUCTS**

##### **2.01 LINK-SEAL® MODULAR SEAL ASSEMBLY**

- A. The Contractor shall furnish and install a complete Link-Seal® modular seal assembly manufactured by PSI-Thunderline/Link-Seal®, Houston, TX. For clarification, complete assembly is defined as a combined:

1. Wall or floor opening (i.e. steel sleeve, Thermoplastic (HDPE) sleeve, cored hole or formed hole). The opening size and/or type shall be selected according to information found in the most recent Link-Seal® modular seal catalog.
2. Sufficient quantity and type of Link-Seal® modular seals required to effectively provide a hydrostatic and/or fire-rated seal.

## **2.02 LINK-SEAL® MODULAR SEAL RUBBER LINKS**

- A. Shall be modular, mechanical type, consisting of inter-locking synthetic rubber links shaped to continuously fill the annular space between the pipe and the wall opening. The elastomeric element shall be sized and selected per manufacturer's sizing procedure and have the following properties as designated by ASTM. Coloration shall be throughout elastomer for positive field inspection. Each link shall have a permanent identification of the size and manufacturer's name molded into it.
  1. Model C (for Standard Service Applications (Pipe))
    - a. -40 to +250°F (-40 to +121°C)
    - b. EPDM = ATSM D2000 M3 BA510
    - c. Color = Black
  2. Model L (for Thin Walled Pipe Applications (Conduit))
    - a. -40 to +250°F (-40 to +121°C)
    - b. EPDM = ATSM D2000 M3 BA510
    - c. Color = Blue

## **2.03 LINK-SEAL® MODULAR SEAL PRESSURE PLATES**

- A. Link-Seal® modular seal pressure plates shall be molded of glass reinforced Nylon Polymer with the following properties:

1. Izod Impact - Notched = 2.05ft-lb/in. per ASTM D-256
  2. Flexural Strength @ Yield = 30,750 psi per ASTM D-790
  3. Flexural Modulus = 1,124,000 psi per ASTM D-790
  4. Elongation Break = 11.07% per ASTM D-638
  5. Specific Gravity = 1.38 per ASTM D-792
- B. Models LS200, 275, 300, and 315 shall incorporate the most current Link-Seal® Modular Seal design modifications and shall include an integrally molded compression assist boss on the top (bolt entry side) of the pressure plate, which permits increased compressive loading of the rubber sealing element.
- C. Models 315, 325, 340, 360, 400, 410, 425, 475, 500, 525, 575, and 600 shall incorporate an integral recess known as a “Hex Nut Interlock” designed to accommodate commercially available fasteners to insure proper thread engagement for the class and service of metal hardware.
- D. All pressure plates shall have a permanent identification of the manufacturer’s name molded into it.

#### **2.04 LINK-SEAL® MODULAR SEAL HARDWARE**

- A. All fasteners shall be sized according to latest Link-Seal® modular seal technical data. Bolts, flange hex nuts shall be 316 Stainless Steel per ASTM F593-95, with a 85,000 psi average tensile strength.

#### **2.05 WATERTIGHT SLEEVES FOR VAULT WALL OPENINGS**

- A. Century-Line® Sleeves - for openings up to 24.81” diameter.
1. Where pipes must pass through vault walls/floors, unless otherwise shown or specified, install molded non-metallic high density polyethylene Model CS Century-Line® sleeves as manufactured by PSI Thunderline/Link-Seal®.
  2. Model CS sleeves shall have integrally formed hollow water stop sized having a minimum of four inches larger than the



outside diameter of the sleeve itself and allowing 1/2" movement between wall forms to resist pour forces. Each sleeve assembly shall have end caps manufactured of the same material as the sleeve itself and installed at exposed ends of the sleeve so as to prevent deformation during the initial concrete pour. End caps shall remain in place to protect the opening from residual debris and rodent entry prior to pipe insertion.

### **PART 3 EXECUTION**

#### **3.01 PREPARATION**

- A. The Contractor shall assure that the proper-sized sleeve with protective covers is in place prior to pouring concrete.

#### **3.02 INSTALLATION**

- A. The Contractor shall install the seal between the pipe and sleeve in accordance with manufacturer's recommendations.

#### **3.03 TESTING – NONE**

**END OF SECTION**

## **SECTION 03070**

### **MISCELLANEOUS JOINT AND CRACK FILLERS**

#### **PART 1 GENERAL**

##### **1.01 SCOPE**

- A. This section includes a description of how the Contractor shall proceed to furnish all material, equipment, labor, services, etc., to complete and install miscellaneous joint and crack filler compounds.

##### **1.02 REFERENCED SECTIONS**

- A. Related Sections are listed below:
  - 1. SECTION 03120 – GROUTING
- B. All joint and crack fillers shall conform to the requirements of the following standard specifications, of the latest revisions, as applicable:
  - 1. ASTM C203 – Standard Test Methods for Breaking Load and Flexural Properties of Block-Type Thermal Insulation
  - 2. ASTM D638 – Standard Test Method for Tensile properties of Plastics
  - 3. ASTM D695 – Standard Test Method for Compressive Properties of Rigid Plastics
  - 4. ASTM D790 – Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials

##### **1.03 CITED STANDARDS – NOT USED**

##### **1.04 NOTED RESTRICTIONS – NOT USED**

##### **1.05 QUALITY CONTROL – NOT USED**

##### **1.06 SUBMITTALS**

- A. Shop Drawings

1. The Contractor shall submit drawings showing the locations of all joints that are to receive these materials.
2. The Contractor shall submit drawings showing the location of filled cracks and materials used.

## **PART 2 PRODUCTS**

### **2.01 JOINT MATERIALS**

#### **A. Preformed Expansion Joint Material**

1. Preformed expansion joint material shall be sponge rubber or bituminous fiber types as specified herein. Specific type to be used in any application shall be as indicated on the Drawings. The Contractor shall submit sufficient information on each type of material to the Lead PRP for review to determine conformance of the material to these Specifications.
2. Thicknesses and dimensions of the materials shall be as indicated on the Drawings or as required according to the way it is used. Expansion joint strips shall be fastened to concrete, masonry, or forms with adhesive. No nailing will be permitted, nor shall expansion joint strips be placed without fastening.

#### **B. Synthetic Sponge Rubber Expansion Joint Material**

1. Synthetic sponge rubber expansion joint material shall be Cementone Code 3329 as manufactured by W. R. Grace and Company; neoprene sponge rubber expansion joint as manufactured by Burke Concrete Accessories Inc.; or equal.

#### **C. Bituminous Fiber Expansion Joint Material**

1. Bituminous fiber expansion joint material shall be Cone Fiber Expansion Joint Fillers Code 1390 as manufactured by W. R. Grace and company; Burke Fiber Expansion Joint; or equal.

## **2.02 SYNTHETIC SPONGE RUBBER FILLER**

- A. Synthetic sponge rubber filler shall be an expanded closed-cell sponge rubber backer rod manufactured from a synthetic polymer neoprene base; or a resilient closed-cell polyethylene foam backer rod. The synthetic sponge rubber filler shall have characteristics suitable for the application intended, including the following:
  - 1. Necessary strength for supporting the sealing compound during application.
  - 2. Sufficient resiliency to prevent significant load transfer across the joint.
  - 3. Resistance to the environmental conditions of the installation.
  - 4. No bonding to the sealing compound.
  - 5. A cellular structure that shall prevent wicking or absorption of water.
  - 6. Compatibility with other materials in the joint, and acceptance by the manufacturer of the sealing compound.
- B. The size of the synthetic sponge rubber filler shall be 25 percent greater than the nominal joint width.
- C. Acceptable products include No. 750.3 Ropax Rod Stock manufactured by the Presstite Division of Interchemical Corporation; Rubatex-Cord manufactured by the Rubatex Corporation; or equal.
- D. Surface preparation and installation of the synthetic sponge rubber filler shall be as recommended by the manufacturer in published instructions. The synthetic sponge rubber filler shall not be stretched beyond its normal length during installation.

## **2.03 CAULKING, JOINTS AND SEALING**

- A. General

1. Expansion, contraction, and construction joints shall be constructed as indicated on the Drawings, and materials used shall be as specified herein.
2. Pipe and conduit shall be installed in structures as indicated on the Drawings, and shall be sealed with the materials specified herein. Doors, windows, louvers, and other items installed in or over concrete openings shall be caulked inside and out with the materials specified herein.

B. Caulking

1. All caulking where indicated on the Drawings or as specified, except for masonry construction and where specified otherwise, shall be done with synthetic rubber sealing compound. Caulking shall be completed prior to painting.

C. Synthetic Rubber Sealing Compound

1. Synthetic rubber sealing compound shall be a multi-part polyurethane designed for continuous submerged condition in water or sewage and exposed to direct sunlight in a dry condition. Synthetic rubber sealing compound shall be PRC 270 as manufactured by Products Research and Chemical Company; Elastothane 227R as manufactured by Pacific Polymers Inc.; or equal. Sealing compound shall comply with Federal Specification TT-S-00227e, Type I (pourable grade) and Type II (non-sag), Class A, and the following requirements.
2. Polyurethane sealant shall have the following properties determined at 75 degrees F and 50 percent relative humidity:
  - a. Base - polyurethane rubber
  - b. Solids - not less than 97 percent
  - c. Application Time - not less than 2 hours
  - d. Cure Time - not more than 3 days

- e. Tack Free Time - 24 hours
- f. Ultimate Hardness - 35 plus or minus 5 (Shore A)
- g. Tensile Strength (ASTM D 412) - 300 pounds per square inch minimum
- h. Ultimate Elongation - not less than 550 percent (ASTM D 412)
- i. Tear Resistance - not less than 85 pounds per inch (ASTM D 624 Die C)
- j. Color shall be gray to match concrete, unless otherwise indicated, and the temperature service range shall be 50 degrees F to 200 degrees F.
- k. Polyurethane sealant shall be a compound designed to cure at room temperature to a firm, highly resilient rubber.

## **2.04 EPOXY MATERIALS**

- A. All epoxy materials shall be new and shall be used within the shelf life limitations set forth by the manufacturer.
- B. Epoxy
  - 1. Epoxy shall be a water-insensitive two-part type low viscosity epoxy adhesive material containing 100 percent solids and shall meet or exceed the following characteristics when tested in accordance with the standards specified:
    - a. ASTM D 638, Tensile Strength: 9,000 psi at 14 days and 77 degrees F cure.
    - b. ASTM D 790, Flexure Strength: 12,000 psi at 14 days and 77 degrees F cure.

- c. ASTM D 695, Compressive Strength: 16,000 psi at 24 hours and 77 degrees F cure.
  - d. Bond Strength: Concrete shall fail before failure of the epoxy.
  - e. Gel Time In A 5-Mil Film: 4 hours maximum at 77 degrees F.
  - f. ASTM D 638, Elongation: 1 percent minimum at 14 days and 77 degrees F.
2. For dry and damp concrete, the epoxy shall be Sikadur Hi-Mod LV as manufactured by the Sika Chemical Corporation; Adhesive Engineering Company Concessive No. 1380; or equal.

C. Epoxy Gel

1. Epoxy gel shall be Sikadur Hi-Mod Gel manufactured by Sika Chemical Corporation; Concessive No. 1438 manufactured by Adhesive Engineering Company; or equal. Epoxy gel shall be used for vertical or overhead work, or where a high viscosity epoxy is required. Epoxy gel for vertical or overhead work may be used for horizontal work. All mixing, installing, and curing of epoxy shall conform to the manufacturer's published instructions.

D. Epoxy Bonding Agent

1. Epoxy bonding agent shall be Concessive No. 1001 LPL as manufactured by Adhesive Engineering; Sikadur Hi-Mod as manufactured by Sika Chemical Corporation; or equal. This material shall be applied in accordance with the manufacturer's published instructions. Bonding agent will not be required for filling form tie holes or for normal finishing and patching of similar sized small defects.

**2.05 EXPANDED POLYSTYRENE**

03070-6

- A. When expanded polystyrene joint filler is indicated on the Drawings or specified, the filler shall be placed in correct position before concrete is placed against the filler. Holes and joints in the filler shall be filled with caulking to prevent the passage of mortar or concrete from one side of the joint to the other.
- B. Expanded polystyrene shall be a commercially available polystyrene board. Expanded polystyrene shall have a flexural strength of 35 pounds per square inch, minimum, determined in accordance with ASTM C 203, and a compressive yield strength of between 16 and 40 pounds per square inch, at 5 percent compression.
- C. When indicated on the Drawings, surface of expanded polystyrene shall be faced with hardboard. Hardboard shall be 1/8 inch minimum thickness, conforming to Federal Specification LLL-B-810, any type. Other facing materials may be used provided they furnish equivalent protection. All boards shall be held in place by nails, waterproof adhesive, or other means approved by the Lead PRP.

## **PART 3 EXECUTION**

### **3.01 CAULKING**

- A. Concrete must be thoroughly cured prior to caulking. All surfaces to be caulked shall be dry, clean, and free of dirt, grease, curing compounds, and other residue which might interfere with adhesion of the caulking compound.
- B. Concrete, masonry, wood, and steel surfaces shall be cleaned and primed in strict accordance with the manufacturer's recommendations prior to caulking. Synthetic sponge rubber filler materials may be used as backing for caulking, if acceptable to the Lead PRP. Filler material, when used, shall be compressible and untreated.
- C. Caulking shall be applied with a pneumatic caulking gun. Nozzles of the proper shape and size shall be used for the application intended. A continuous bond shall be maintained between the caulking and the sides of the joint to eliminate gaps, bubbles, or voids and to fill the



joint in a continuous operation without layering of the compound. All joints and seams shall be caulked by experienced applicators in a neat workmanlike manner.

- D. No caulking shall be applied when the temperature exceeds 120 degrees F to avoid sponging or bubbling of compound. To hasten curing of the compound when used on wide joints subject to movement, the Contractor shall apply heat with infra-red lamps or other convenient means.
- E. Excess caulking shall be removed by soaking and scrubbing before caulking has cured with Chem Seal CS9900; equivalent product of Products Research and Chemical Corporation; or equal. Excess cured material shall be removed by sanding with No. 80 grit sandpaper.

### **3.02 SYNTHETIC RUBBER SEALING COMPOUND**

- A. All surfaces to which synthetic rubber must bond shall be dry and free of dust, dirt, and other foreign residue, heavy sandblasted caulking groove to provide a sound surface, and shall be primed with the manufacturer's recommended primer for the particular surface.
- B. Application shall be in strict accordance with the manufacturer's published instructions. Application shall be by means of a pneumatic caulking tool or other acceptable method.
- C. All packages shall be code dated. No material shall be more than six months old when used. Material shall have been kept at temperatures lower than 80 degrees F at all times.

### **3.03 EPOXY INJECTION SYSTEM**

- A. Where epoxy injection is required to repair cracks in concrete material, information on the epoxy injection system shall be submitted.
- B. Adequate surface seal shall be applied to the crack or joint to prevent escape of the epoxy. Entry points shall be established at a distance along the seal not less than the thickness of the cracked member.

- C. A 100 percent solid epoxy adhesive as specified above shall be forced into the crack at the first port with sufficient pressure to advance the epoxy to the adjacent port. The original port shall be sealed and entry shifted to the port at which the epoxy appears. This manner of port-to-port injection shall be continued until each joint has been injected for its entire length.
- D. Before processing, the space in the vicinity of a crack location receiving epoxy shall have been swept and left in a generally clean condition. All joints receiving epoxy under this section shall be cleaned free from dirt, laitance, and other loose matter.
- E. Pump unit used for injection shall be a positive displacement type with interlock to provide an in-line mixing and metering system for the two component epoxy. The pressure hoses and injection nozzle shall be of such a design as to allow proper mixing of the two components of epoxy. The presence of a standby injection unit may be required.
- F. For small amounts, or where excessive grout pressure developed by a pump unit might further damage the structure, premixed material and a hand caulking gun may be used if acceptable to the Lead PRP.
- G. Seal all ports, including adjacent locations where epoxy seepage occurs, as necessary to prevent drips or run out. Any condition other than normal shall be reported to the Lead PRP. Solvents may not be used to thin the epoxy system introduced into the cracks or joints. All work under this Specification shall be performed and conducted in a neat orderly manner.

**END OF SECTION**

**SECTION 03080**  
**REINFORCING STEEL**

**PART 1      GENERAL**

**1.01   SCOPE**

- A.      This section includes a description of how the Contractor shall proceed to furnish all material, equipment, labor, services, etc., to provide steel reinforcing bars for concrete reinforcement.

**1.02   REFERENCED SECTIONS - NONE**

**1.03   CITED STANDARDS**

- A.      All reinforcing steel shall conform to the requirements of the following standard specifications, of the latest revisions, as applicable:
  - 1.      ACI 315 – Details and Detailing of Concrete Reinforcement
  - 2.      ACI 318 – Building Code Requirements for Structural Concrete
  - 3.      ASTM A185 – Standard Specification for Welded Steel Wire Fabric for Concrete Reinforcement
  - 4.      ASTM A370 - Test Methods and Definitions for Mechanical Testing of Steel Products
  - 5.      ASTM A615 – Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
  - 6.      AWS D1.4 – Structural Welding Code – Reinforcing Steel
  - 7.      CRSI Manual of Standard Practice

**1.04   NOTED RESTRICTIONS – NONE**

**1.05   QUALITY CONTROL**

- A.      The Contractor shall receive approval from the Lead PRP's Representative prior to movement or rearrangement of reinforcement

bars if any adjustments need to be made in order to avoid interference with other embedded items.

## **1.06 SUBMITTALS**

- A. The Contractor shall submit mill test certificates identifying chemical and physical analyses of each load of reinforcing steel delivered. If mill test reports are unavailable and the quantity of steel for a structure exceeds 5 tons, provide a laboratory test to prove conformance with the specified ASTM standard.
- B. Epoxy Coating: Certification by reinforcing steel supplier that epoxy coating meets specified requirements, prior to coated reinforcing steel installation.
- C. The Contractor shall submit reinforcing bending lists and placing drawings for all reinforcing. Placing drawings shall indicate all openings (mechanical, electrical, equipment, and architectural) including additional reinforcing at openings and corner bar arrangements at intersecting beams, walls, and footings indicated in the typical detail and structural drawings. Placing drawings shall be coordinated with the concrete placing schedule. Each bending list and placing drawing submitted shall be complete for each major element of a structure (grade slabs, footings, walls, deck, floor, or roof slabs) including dowels and corner bars. Furnishing such lists shall not be construed that the lists will be reviewed for accuracy.
- D. The Contractor shall be wholly and completely responsible for the accuracy of the lists and for furnishing and placing reinforcing steel in accordance with the details shown on the plans and as specified. Calculated weights of the bars shall be as specified in ACI 318. Detailing of the reinforcing steel shall be in accordance with ACI 315.
- E. Product Data
  - 1. The Contractor shall submit the Manufacturer's product data for reinforcement materials and accessories.
- F. Certificates

1. The Contractor shall also submit a certificate of compliance stating that the grades and properties of the reinforcing steel are in conformance with ASTM A370, and any other applicable ASTM Standards.

## **1.07 DELIVERY AND STORAGE**

- A. Reinforcing bars shall be delivered in bundles limited to one size and length of bar, securely tied and identified with plastic tags including the mill, heat number, and grade and size of the bars.
- B. The bars shall be placed in storage shall be stored off the ground and protected from moisture, dirt, and other contaminants that could cause an impaired bond with concrete.
- C. Handling equipment for epoxy-coated reinforcing bars shall have protected contact areas and bundles of coated bars shall be lifted at multiple pick points to minimize bar coating abrasion. Epoxy-coated bars shall not be dropped or dragged, and shall be stored off of ground on padded cribbing. Damaged areas on epoxy-coated bars that exceed 0.10 sq. inches shall be repaired to achieve the minimum coating thickness specified in ASTM A 775. The maximum amount of damage including repaired and unrepaired areas shall not exceed 2 percent of the surface area of each bar.

## **PART 2 PRODUCTS**

### **2.01 GENERAL**

- A. Reinforcement shall be of the size shown on the Drawings.
- B. All reinforcing steel shall be new material, of the quality specified, free from excessive rust or scale or any defects affecting its usefulness.

### **2.02 REINFORCEMENT BARS**

- A. Reinforcing bars shall conform to the requirements of the "Standard Specifications for Deformed Billet Steel Bars for Concrete Reinforcement" (ANSI/ ASTM A615). Reinforcing bars shall be Grade

60 deformed bars conforming to ASTM A 615. No field bending of bars will be allowed. All reinforcement bars lacking grade identification marks shall on delivery be accompanied by a manufacturer's guarantee of grade.

- B. Epoxy-Coated Reinforcing Steel: Reinforcing steel shall be deformed bars conforming to ASTM A 615, grades and sizes as indicated. Epoxy coating shall be applied to straight bars per ASTM A 775 with bar fabrication/bends performed on the coated bars. Coating thickness, damage, and repair shall be as specified in ASTM A 775, unless otherwise noted herein. Coating shall be applied in an Epoxy Coating Applicator Plant in accordance with the CRSI Voluntary Certification program, or equivalent. Refer to drawings for specific locations requiring epoxy-coated reinforcing steel.
- C. All bars shall be new stock free from rust scale, loose mill scale, excessive rust, dirt, oil, and other coatings which adversely affect bonding capacity when placed in the work. A thin coating of red rust resulting from short exposure will not be considered objectionable, but any bars having rust scale, loose mill scale, or a thick rust coat shall be thoroughly cleaned, or shall be rejected and removed from the premises upon order of the Lead PRP.
- D. Bars shall be delivered bundled and tagged with identifying tags.
- E. Bars shall be cut and bent in accordance with the provisions of ACI 315 and ACI 318. All bars shall be bent cold. Bars shall be free from defects and kinks and from bends not indicated on the Drawings.
- F. Reinforcing bars shall be welded where indicated on the Drawings or acceptable to the Lead PRP. Welding shall be performed in accordance with AWS D1.4 "Structural Welding Code-Reinforcing Steel.
- G. Reinforcement shall be accurately formed to the dimensions indicated on the drawings. All bars shall be bent cold. Diameter of bend measured on inside of bar, other than for stirrups and ties in sizes No. 3 through No. 5, shall not be less than specified in Table 3E-1. Inside diameter of bends for stirrups and ties shall not be less than 4 bar

diameters for No. 5 bar and smaller. For bars larger than No. 5, diameter of bend shall comply with Table 3E-1 shown on the next page.

H.

Table 3E-1 – Min. Diameters Of Bend	
Bar Size	Min. Diameter
No. 3 through 8	6 Bar Diameters
No. 9, 10, and 11	8 Bar Diameters
No. 14 and 18	10 Bar Diameters

### 2.03 BAR SUPPORTS

- A. Bar supports shall be hot-dip galvanized steel, shall conform to ACI 315, and shall be furnished in sufficient number to prevent sagging and to support loads during construction, but in no case shall the quantities and locations of the supports be less than indicated in ACI 315. Bar supports, where used in slabs which will be exposed to view, shall be equipped with plastic tips. Reinforcing for concrete placed on the ground shall be supported by standard manufactured chairs, with steel plates for resting on the ground. No use shall be made of brick, broken concrete masonry units, spalls, rocks, or similar material for supporting reinforcing steel.
- B. The Contractor shall submit samples of all chairs he proposes to use along with a letter stating where each type chair will be used. No concrete shall be placed until this prior acceptance has been obtained.

### 2.04 WELDED WIRE FABRIC

- A. Welded wire fabric shall be welded wire fabric in accordance with "Specification For Welded Steel Wire Fabric For Concrete

Reinforcement" (ANSI/ASTM A185). It shall be of new stock, free from excessive rust when placed in the work. All necessary wiring, spacing chairs, or supports shall be installed to keep the welded wire fabric in place while concrete is being placed. The welded wire fabric shall be bent as shown or required to fit the work. Welded wire fabric shall be rolled or otherwise straightened to make a perfectly flat sheet before placing in the Work. Welded wire fabric shall be lap spliced as indicated on the Drawings. If the lap splice length is not indicated on the Drawings, the welded wire fabric shall be spliced in accordance with ACI 318.

- B. Welded wire fabric may be used in place of reinforcing bars if accepted by the Lead PRP. The welded wire fabric shall be furnished in flat sheet form. The cross-sectional area per linear foot of wire fabric shall be not less than the cross-sectional area per linear foot of reinforcing bars indicated on the Drawings.

## **2.05 ACCESSORIES**

- A. The Contractor shall furnish and install all accessories including necessary chairs or bolsters, concrete blocks (dobies), tie wires, supports, spacers and other devices to position reinforcement during concrete placement.
- B. Wire bar supports shall be made of plain cold-drawn steel wire with pre-molded, gray-colored, plastic tips to the legs of the support. The plastic shall have a thickness of 1/8-inch or greater at points of contact with formwork and extend upward on the wire a minimum of 1/2-inch. Wire sizes and geometric dimensions shall be made in accordance with Table II of the latest edition of CRSI Manual of Standard Practice.
- C. Concrete blocks (dobies), used to support and position reinforcement steel, shall have the same or higher compressive strength as specified for the concrete in which it is located. Where the concrete blocks are used on concrete surfaces exposed to view, the color and texture of the concrete blocks shall match that required for the finished surface. Wire ties shall be embedded in concrete block bar supports.



- D. For support of epoxy coated bars, cold-drawn steel wire supports shall be coated with a dielectric material such as epoxy that is compatible with concrete. Reinforcing bars used to support epoxy-coated bars shall be epoxy-coated. Bar clips or spreaders used in walls with epoxy-coated bars shall be corrosion resistant. Precast concrete blocks used to support epoxy coated reinforcing at slabs on ground shall have epoxy-coated or plastic coated wires embedded therein.
- E. The wire tie shall be 16-gauge or heavier, black annealed.
- F. Wire ties used with epoxy-coated bars shall be epoxy or nylon coated and applied in a manner to avoid cutting into or otherwise damaging epoxy coating.

## **2.06 MECHANICAL COUPLERS**

- A. Mechanical couplers shall be provided where shown and where approved by the Lead PRP's Representative. The couplers shall develop a tensile strength which exceeds one hundred and fifty percent (150%) of the yield strength of the reinforcement bars being spliced at each splice.

## **2.07 MECHANICAL CONNECTIONS**

- A. Mechanical Connections shall be LENTON taper threaded couplers by ERICO.
- B. The Mechanical Connection shall meet building code requirements of developing in tension or compression, as required by ACI 318. The Mechanical Connection shall be the positive locking, taper treaded type coupler manufactured from high quality steel. The bar ends must be taper threaded using the manufacturer's requirements. The couplers shall be manufactured using registered quality systems around the world.

## **PART 3 EXECUTION**

### **3.01 PREPARATION – NONE**

### 3.02 INSTALLATION (PLACING REINFORCEMENT)

- A. Metal reinforcement shall be placed in accordance with ANSI/ACI 318, except as otherwise noted herein and accurately positioned in accordance with the information on the drawings. Protective concrete cover shall be as required in ANSI/ACI 318. Reinforcement shall be secured against displacement by using annealed iron wire-ties or suitable clips at intersections, and shall be supported by concrete or metal supports, spacers, or metal hangers.
- B. Reinforcing bars shall be accurately placed and adequately secured in position. Bars at splices shall overlap as specified or indicated on the Drawings. Unless specifically otherwise indicated on the Drawings, the bars at a lap splice shall be in contact with each other and the bars shall be fastened together with tie wire. When it is necessary to splice reinforcement at points other than shown on the drawings, the character of the splice shall be determined by the Lead PRP's Representative. The overlap in splices in reinforcing steel shall be as specified on Detailed Drawings. If the lap splice length is not specified or indicated on the Drawings, bars shall be lap spliced in accordance with ACI 318. Lap splices for masonry, if not specified or indicated on the Drawings and not specified in the section on masonry, shall be in accordance with the Uniform Building Code.
- C. Bars shall be fastened securely in place with annealed steel wire ties. Bars shall be tied sufficiently often to prevent shifting. There shall be at least three ties in each bar length (does not apply to dowel laps or to bars shorter than 4 feet, unless necessary for rigidity). Slab bars shall be tied at every intersection around the periphery of the slab. Wall bars and slab bar intersections other than around the periphery shall be tied at not less than every fourth intersection, but at not greater than the following maximum spacings:

Slab	Wall
Bars,	Bars,
<u>      inches      </u>	<u>      inches      </u>

Bars No. 5 and smaller	60	48
Bars No. 6 through No. 9	96	60
Bars No. 10 and No. 11	120	96

Note: The above tying requirements do not apply to reinforcement for masonry.

- D. Tie wires shall be bent away from the forms in order to provide the specified concrete coverage.
- E. Bars additional to those shown which may be found necessary or desirable by the Contractor for the purpose of securing reinforcement in position shall be provided by the Contractor at its own expense.
- F. Placing Tolerances - Unless otherwise specified, reinforcement placing tolerances shall be within the limits specified in ACI 318, except where in conflict with the requirements of The Building Code.
- G. The clear distance between parallel bars (except in columns and between multiple layers of bars in beams) shall be not less than the nominal diameter of the bars nor less than 1-1/3 times the maximum size of the coarse aggregate, nor less than 1-inch.
- H. Where reinforcement in beams or girders is placed in two (2) or more layers, the clear distance between layers shall be not less than 1-inch
- I. Bars may need to be moved to avoid interference with other reinforcement steel, conduits or embedded items. If bars are moved more than one bar diameter, or enough to exceed the above tolerances, the resulting arrangement of bars shall be as acceptable to the Lead PRP's Representative. Additional bars may be necessary to prevent cracking or provide additional reinforcement in this case and shall be provided by the Contractor at its own expense.

- J. Unless otherwise indicated on the Drawings, reinforcement shall be placed so as to provide the thickness of protective concrete covering as indicated on the Drawings. If not indicated on the Drawings, the protective concrete cover shall be in accordance with ACI 318.
- K. Metal reinforcement before being positioned, shall be free from loose mill and rust scale, and from coatings including ice that destroy or reduce the bond. Where there is delay in depositing concrete, reinforcement shall be re-inspected and cleaned when necessary.
- L. All laps of wire mesh shall be one width of wire spacing, and adjoining sheets shall be securely tied together with No. 14 tie-wire, one tie for each 2 running feet. At laps, wires shall be staggered and tied in such a manner that they cannot slip.
- M. Welded wire fabric placed over the ground shall be supported on wired concrete blocks (dobies) spaced not more than three (3) feet on centers in any direction. The construction practice of placing welded wire fabric on the ground and hooking into place in the freshly placed concrete shall not be used.
- N. Exercise care in placement of epoxy-coated bars and in protection of bars after placing to minimize abrasions. Damaged coating that exceeds limits established herein shall be repaired in accordance with ASTM A 775, or the bar shall be replaced. Flame cutting of epoxy-coated reinforcing bars is prohibited.

### **3.03 FIELD QUALITY CONTROL**

- A. The Lead PRP will employ and pay a qualified independent testing agency to perform the following testing for field quality control and inspections, including special inspections required by local building code. Retesting of materials failing to meet specified requirements shall be done at Contractor's expense.
  - 1. Perform visual inspection prior to reinforcement placement for verification of size, type, grade, and quality of materials.

2. Observe and report on placement of reinforcement, including size, quantity, vertical location, horizontal spacing, correctness of bends, splices, clearance between bars and forms, top/bottom concrete cover, firmness of installation, type of supports, and security of supports and ties, immediately prior to concreting.
3. Observe and report on placement of embedded items, including size, vertical location, horizontal spacing, correctness of fabrication, and firmness of installation immediately prior to concreting.
4. Observe and report on damage, if any, to epoxy-coated reinforcing bars which exceeds limits specified herein. Note acceptability of repair(s).

**END OF SECTION**

## **SECTION 03090**

### **CAST-IN-PLACE CONCRETE**

#### **PART 1 GENERAL**

##### **1.01 SCOPE**

- A. The Contractor shall furnish all material, equipment, labor, services, etc., to complete and install all concrete work as specified in this section.

##### **1.02 REFERENCED SECTIONS – NONE**

##### **1.03 CITED STANDARDS**

- A. All cast-in-place concrete shall conform to the requirements of the following standard specifications, of the latest revisions, as applicable:
  - 1. ACI 211.1 – Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete
  - 2. ACI 301 – Specifications for Structural Concrete
  - 3. ACI 304 – Measuring, Mixing, Transporting, and Placing Concrete
  - 4. ACI 305 – Hot Weather Concreting
  - 5. ACI 315 – Details and Detailing of Concrete Reinforcement
  - 6. ACI 318 – Building Code Requirements for Structural Concrete
  - 7. ACI 350R - Environmental Engineering Concrete Structures
  - 8. ACI SP-15 - Field Reference Manual. A copy of this publication must be kept in the field office at all times during concrete construction.
  - 9. ASTM C31 – Standard Practice for Making and Curing Concrete Test Specimens in the Field
  - 10. ASTM C33 – Standard Specification for Concrete Aggregates

11. ASTM C39 – Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens
12. ASTM C40 - Standard Test Method for Organic Impurities in Fine Aggregates for Concrete
13. ASTM C88 – Standard Test Method for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate
14. ASTM C94 – Standard Specification for Ready-Mix Concrete
15. ASTM C114 – Standard Test Methods for Chemical Analysis of Hydraulic Cement
16. ASTM C117 – Standard Test Method for Materials Finer than 75µm (No. 200) Sieve in Mineral Aggregates by Washing
17. ASTM C123 – Standard Test Method for Lightweight Particles in Aggregate
18. ASTM C136 – Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates
19. ASTM C142 – Standard Test Method for Clay Lumps and Friable Particles in Aggregates
20. ASTM C150 – Standard Specification for Portland Cement
21. ASTM C295 – Standard Guide for Petrographic Examination of Aggregates for Concrete
22. ASTM C494 – Standard Specification for Chemical Admixtures for Concrete
23. ASTM D75 – Standard Practice for Sampling Aggregates
24. CRSI - Manual of Standard Practice

**1.04 NOTED RESTRICTIONS – NONE**

**1.05 QUALITY CONTROL**

- A. The concrete shall conform to all provisions of the latest edition of the (ASTM) American Society for Testing and Materials and the (ACI) American Concrete Institute noted within this specification, except as modified by the Supplemental Requirements contained herein.
- B. All work shall be performed to secure for the entire job homogeneous concrete having required strength, durability, and weathering resistance, without planes of weakness and other structural defects and free of pronounced honeycombs, air pockets, voids, projections, offsets of plane, and other defacements on exposed surfaces.
- C. Shop drawings for reinforcing steel and accessories shall be prepared in accordance with "Details and Detailing of Concrete Reinforcement," ACI 315.
- D. Manufacturer's Data: For information only and as requested by the Lead PRP's Representative, submit two (2) copies of manufacturer's data with application and installation instructions for all proprietary materials.
- E. Substitutions: Any request for product substitution must be submitted for review, with all necessary documentation, prior to time of bid. No requests for substitutions will be considered after bid has been received.
- F. Throughout the specifications, types of materials may be specified by the manufacturer's name in order to establish standards of quality and performance and not for the purpose of limiting competition. Unless specifically stated otherwise, the Bidder may assume the phrase "or approved equal," except that the burden is upon the Bidder to prove such equality. If the Bidder elects to prove such equality, it must request the Lead PRP's Representative's approval in writing to substitute such item for the specified item, stating the cost difference involved with supporting data, and samples if required, to permit a fair evaluation of the proposed substitute with respect to quality, serviceability, warranty, and cost.
- G. This work is intended to cover all phases of concrete control, testing, and inspection necessary to assure an in-place concrete of high structural quality and durability. The concrete to be used in this project



shall be ready-mixed concrete in conformity with ANSI/ASTM C94 except as revised or amended hereinafter or with approval of the Lead PRP's Representative.

- H. The work shall include those items below and hereinafter described.
  - 1. Sampling and testing of component materials
  - 2. Trial mix design
  - 3. Preparation of field specimens
  - 4. Testing of field specimens
  - 5. Batch plant inspection
- I. Sampling and testing of component materials and trial mix design.
  - 1.05G.1. and 2.
  - 1. The Contractor shall notify the testing laboratory as soon after award of the Contract as possible of his source of supply for the concrete work, whereupon the laboratory shall proceed with items 1.05G.1. and 2. and shall deliver to the Lead PRP's Representative a written report in triplicate covering these items. Proportions of cement, aggregates, and water necessary to produce a concrete conforming to the specifications contained in Part 2 Products below shall be determined by means of the laboratory tests of concrete made with the cement and aggregates to be used on the work and in accordance with ANSI/ACI Standard 211.1. The reports shall be delivered to the Lead PRP's Representative within 2 weeks after notification from the Contractor, and shall include the 7-day cylinder breaks for item 1.05G.1.b. Another report, in triplicate, shall be delivered to the Lead PRP's Representative after the 28-day cylinder breaks are completed. The reports shall be based on not less than 4 concrete test specimens for each age. Strengths so determined shall be 15% greater than those called for in the above referenced specifications.
  - 2. The testing laboratory shall make such field adjustments to the trial mix design as are necessary to produce a concrete of the

desired workability, durability, and compressive strength. However, once a final design for the various classes of concrete has been decided upon, no deviation from that design shall be permitted without the express written consent of the Lead PRP's Representative.

3. If during the progress of the work the Contractor requests a change in the materials originally approved and if such a request is granted by the Lead PRP's Representative, or if the materials from the sources originally approved change in characteristic, the Lead PRP's Representative may at his option require that a new design mix be established or the new component materials be subjected to the same tests as previously specified. The cost for such work would be borne by the Contractor. The testing laboratory shall determine that the new materials or combination of materials will produce concrete of the same quality as originally approved and will not bring about objectionable changes in the color or appearance of the structure.

J. Preparation of Field Specimens, Item 1.05G.3.

1. During the progress of construction, tests (slump, strength, air) shall be made by the testing laboratory to determine whether the concrete being produced complies with the standards of quality specified herein.
2. A set of concrete field specimens shall consist of four (4) 6 in. by 12 in. cylinders made and cured by the testing laboratory, or if item 2-c is not required, by the Contractor in accordance with Method of Making and Curing Concrete Compression and Flexure Test Specimens in the Field, ANSI/ASTM C31. Concrete shall be sampled in the field for each day's pour as follows:
  - a. 2 sets for first 25 cu yd or fraction thereof except as stated hereinafter.
  - b. 1 set for each additional 50 cu yd or fraction thereof after the first 25 cu yd.

- c. 1 set for structural placements under 10 cu yd in 1 day.
- d. A minimum of 2 sets for pours greater than 25 cu yd (total required).
- e. A slump test (ASTM C 143) and air test (ASTM C 231) each 25 cu yd.
- f. All cylinders shall be tagged numerically, such tags indicating date of pour, exact location in the work at which each load represented by the cylinders is located, and the delivery ticket number of the load from which the specimen was made.
- g. The Lead PRP's Representative or Lead PRP reserve the right to alter the number of cylinders made or broken.

K. Testing of Field Specimens, Item 1.05G.4.

- 1. Testing of each set of concrete cylinders shall be accomplished in accordance with Standard Method of Tests, ANSI/ASTM C39.
- 2. 1 cylinder of each set at age 7 days.
- 3. 2 cylinder of each set at age 28 days.
- 4. 1 cylinder of each set held in reserve for the direction of the Lead PRP's Representative.

L. Batch Plant Inspection, Item 1.05G.5.

- 1. The testing laboratory shall place a man at the batch plant to inspect the batch plant operations and to verify that the concrete being delivered to the job is in accordance with the specifications.
- 2. The testing laboratory representative shall prepare delivery tickets for each load of concrete delivered to the job site and shall give same to the truck drivers for delivery to the Lead

PRP's Representative at the job site. The tickets shall contain the following information:

- a. Number of yards delivered.
  - b. Quantity of materials in the batch.
  - c. The time at which the truck left the batching plant.
  - d. The time at which the cement was added.
  - e. The outdoor temperature in the shade.
  - f. The numerical sequence of the delivery.
3. The representative of the laboratory shall make all necessary tests and shall inspect all weighing and control apparatus to insure that the component materials of the concrete being produced meet the specification requirements and the design mix proportions, and shall stop shipment of any concrete not so complying.
  4. He shall also inspect the storage facilities of the batch plant to insure that the component materials are properly stored. Tests of the moisture content of all aggregates shall be made whenever necessary, but at least once every mixing day.

#### **1.06 SUBMITTALS**

- A. Submit concrete mix design at least 15 days before placing concrete. Mix designs shall be signed and stamped by a registered civil or structural Engineer.
- B. Submit six (6) copies of a report from a testing laboratory verifying that aggregate material contains less than 1% asbestos by weight or volume and conforms to the specified gradations or characteristics.
- C. Submit six copies of lab compressive test results for a proposed mix design. Tests may be for trial batches or past tests for the same identical mix design for this work.

- D. Submit six (6) copies of certification stating that cement and aggregates meet the requirements of ASTM C150 and C33 respectively.

## **1.07 STORAGE OF MATERIALS**

- A. Cement and aggregates shall be stored in such a manner as to prevent deterioration of or contamination with foreign matter.
- B. Fine and coarse aggregate shall be stored separately and in such a manner as to avoid segregation. Cement, which has become caked, partially set, or otherwise deteriorated, or any material, which has become damaged or contaminated, shall be rejected for use.

## **PART 2 PRODUCTS**

### **2.01 MATERIALS**

- A. These classes of concrete shall have a minimum weight of 140 pounds per cubic foot. Class C concrete may be used for fill for unauthorized excavation, for thrust blocks and ground anchors for piping, for bedding of pipe, and where indicated on the Drawings.
- B. Except as otherwise specified, concrete shall be composed of Portland cement, fine aggregate, coarse aggregate, and water so proportioned and mixed as to produce a plastic, workable mixture in accordance with all requirements of these Specifications and suitable to the specific conditions of placement. The proportions of materials shall be such as to secure the lowest water/cement ratio which is consistent with good workability, a plastic, cohesive mixture, and one which is within the specified slump range. The proportion of fine and coarse aggregate shall be such as not to produce harshness in placing or honeycombing in the structures.
- C. Concrete that is pumped shall meet all the requirements of these Specifications. Concrete with a slump outside the limits indicated in the above Table shall not be placed.
- D. Classes A, C, concrete shall be made with Type V, Low Alkali Portland cement. Type I or Type II cement may be used if soil sulfate levels, as determined by a geotechnical Engineer, are sufficiently low. A document, signed by a licensed geotechnical Engineer stating that

Type I or Type II cement may be used, shall accompany each mix design where the use Type I or Type II is proposed.

- E. All cement shall be stored in a suitable way to protect the cement from dampness in a way to be easily inspected and to permit easy identification of each shipment. Facilities shall be provided for inspection and sampling of stored cement being used. The cement shall be rejected if it fails to meet any of the requirements of these specifications.
- F. Fly ash (Alternate): Fly ash shall meet the requirements of ASTM C618, Class C, F or N with the exception of loss of ignition, where the maximum shall be less than 6 percent for Class F or N.
- G. All admixtures shall be approved by the Lead PRP and shall be added to the concrete in strict accordance with the recommendation of the manufacturer.
- H. Water used in mixing and curing concrete shall be fresh, clean and free from injurious amounts of sewage, oil, acid, alkali, organic matter or other deleterious substances. Water shall be approved for human consumption.
- I. Concrete aggregate shall conform to the "Specifications For Concrete Aggregate", ANSI/ASTM C33, except as revised. Aggregate shall be certified by an independent commercial testing laboratory to show compliance with the above-mentioned specifications.

## **2.02 AGGREGATES**

- A. All concrete aggregates shall be sound, uniformly graded, and free of deleterious material in excess of the allowable amounts specified.
- B. The Contractor shall furnish the Lead PRP certified copies in triplicate of commercial laboratory tests of all samples of concrete aggregates submitted. Tests on concrete aggregates shall indicate as a minimum all specified tests. All concrete aggregate tests shall be at the Contractor's expense.
- C. Aggregate shall be sampled and graded in accordance with ASTM D 75 and C 136.

- D. Sieves for testing grading of aggregates shall have square openings.
- E. Sieve analyses of the fine and coarse aggregates being used shall be furnished to the Lead PRP in triplicate at any time there is a significant change in the grading of the materials, and in any event, shall be furnished at least every three weeks. If such sieve analyses indicate a significant change in the materials, the Lead PRP may require that a new mix design be submitted for review and acceptance before further placing of concrete.
- F. If either fine or coarse aggregate is to be batched from more than one bin, analyses shall be furnished for each bin, and a composite analysis made up from these, using the proportions of materials to be used in the mix.
- G. The unit weight of fine and coarse aggregate shall be of a unit weight which will produce in place concrete with a weight of not less than 140 pounds per cubic foot.
- H. Fine Aggregates
1. Only clean, natural sand shall be used. Artificial or manufactured sand will not be acceptable. The grading of the fine aggregate shall be as shown in the table below:

Sieve Designations	Percent Passing
3/8 in.	100
No. 4	95-100
No. 8	80-90
No. 16	50-75
No. 30	30-50
No. 50	10-20
No. 100	2-5

2. Deleterious substances shall not be present in excess of the following percentages by weight of contaminating substances. In no case shall the total exceed 3 percent.

<u>Material</u>	<u>Test Method</u>	<u>Percent</u>
Removed by decantation (dirt, silt, etc.)	ASTM C 1173	3
Shale or chert	ASTM C 2951	1
Clay Lumps	ASTM C 142	1

3. Fine aggregate shall not contain strong alkali or organic matter which gives a color darker than the standard color when tested in accordance with ASTM C 40. Except as otherwise specified, fine aggregate shall be graded from coarse to fine in accordance with the requirements of ASTM C 33. Aggregate soundness shall comply with the requirements of ASTM C 33 when tested in accordance with ASTM C 88. Aggregate shall comply with the reactivity requirements contained in ASTM C-33.

I. Coarse Aggregate

1. Coarse aggregate shall consist of gravel or crushed stone made up of clean, hard, durable particles free from calcareous coatings, organic matter, or other foreign substances. Thin or elongated pieces having a length greater than five times the average thickness shall not exceed 15 percent by weight.
2. Deleterious substances shall not be present in excess of the following percentages by weight, and in no case shall the total of all deleterious substances exceed 2 percent:



Material	Test Method	Percent
Shale or chert	ASTM C 295	1
Coal and lignite	ASTM C 123	1/4
Clay lumps and *friable particles	ASTM C 142	1/4
Materials finer than No. 200 sieve	ASTM C 117	1/2*

\*when material finer than No. 200 sieve consists of crusher dust, the maximum amount shall be 1 percent.

3. The coarse aggregate shall conform to the following limits:
  - a. Sodium sulfate test - 10% max loss
  - b. L. A. abrasion test - 35% max loss
  - c. Crushed particles (gravel) - 45% min loss
4. The gradations required for the coarse aggregate are 8 to 18 percent for the top size aggregates and 8 to 22 percent for smaller top size aggregates retained on each sieve.

## 2.03 WATER

- A. Water for concrete, washing aggregate, and curing concrete shall be clean and free from oil and deleterious amounts of alkali, acid, organic matter, or other substances. Water shall not contain more than 1,000 milligrams per liter of chlorides calculated as chloride ion, or more than 1,000 milligrams per liter of sulfates calculated as sulfate ion for conventional reinforced concrete. Water for pre-stressed or post-tensioned concrete shall not contain more than 650 milligrams per liter of chlorides calculated as chloride ion, nor more than 800 milligrams per liter of sulfates calculated as sulfate ion.

## 2.04 PORTLAND CEMENT

- A. Except as otherwise specified all Portland cement shall conform to the specifications and test for Portland cement ASTM C 150, Types V, Low Alkali. Low alkali Portland cement shall contain no more than 0.6 percent total alkali. The word "alkali" shall be taken to mean the sum of sodium oxide and potassium oxide calculated as sodium oxide. The determination for total alkali shall be made by the method set forth in ASTM C 114. Only one brand of Portland cement shall be used for exposed concrete in any individual structure.
- B. Certified copies in triplicate of mill tests representative of each shipment of cement shall be furnished to the Lead PRP for verification of compliance with these Specifications. Mill tests on cement shall include a report on alkali content.

## **2.05 ADMIXTURES**

- A. Admixtures of any type, except as otherwise specified, shall not be used unless written authorization has been obtained from the Lead PRP. Admixtures used shall be compatible with the concrete and other admixtures. Admixtures shall be used in accordance with the admixture manufacturer's recommendations and shall be added separately to the concrete mix. Water reducing admixture shall conform to ASTM C494, Type A, and not contain more chloride ions than are present in municipal drinking water. Air entraining shall comply with ASTM C260.
- B. Calcium chloride, thiocyanates or admixtures containing more than 0.05 percent chloride ions are not permitted.
- C. Written conformance to the above-mentioned requirements and the chloride ion content of the admixture will be required from the admixture manufacturer prior to mix design review by the Lead PRP or the Lead PRP's Representative.

## **2.06 CONCRETE MIXES**

- A. All mixes shall be approved by the Lead PRP or the Lead PRP's Representative prior to use on the job. No deviations from the

approved mixes shall be permitted without prior approval from the Lead PRP or the Lead PRP's Representative.

- B. Where the concrete production facility can establish the uniformity of its production for concrete of similar strength and materials based on recent test data, the average strength used as a basis for determining mix design proportions shall exceed the specified design strength by the requirements of ACI 318, Section 4.3 or ACI 301, Section 3.9.
- C. When a concrete production facility does not have field test records for calculation of standard deviation, the required average strength shall be at least 1200 psi greater than the specified design strength.
- D. The Contractor shall submit the mix design accompanied by complete standard deviation analysis or trial mixture test data.
- E. Concrete mixes shall be designed and proportioned in such a manner that required minimum ultimate strength, compressive strength, minimum shrinkage and optimum workability will be obtained. The concrete shall be of such consistency and composition that it can be worked readily into all corners and angles of the forms and around reinforcement or other objects without permitting materials to segregate or free water to collect on the surface.
- F. All concrete used for the encasement of electrical ducts, conduits, etc. shall be colored red by mixing into each cubic yard of concrete 10 pounds of red oxide No. 1117 as manufactured by the Frank D. Davis Company; equivalent product by I. Reiss Company, Inc.; or equal.

## **PART 3 EXECUTION**

### **3.01 PREPARATION**

- A. The Contractor shall submit the ready-mix design from the batchplant used accompanied by complete standard deviation analysis or trial mixture test data.
- B. All mixes shall be approved by the Lead PRP's Representative prior to use on the job. No deviations from the approved mixes shall be permitted without approval from the Lead PRP's Representative.

- C. All concrete shall contain a minimum of 4% +/- 1% entrained air.
- D. The concrete shall arrive at the job site at a slump of 2" to 4". The Contractor shall perform slump test to be witnessed by the Lead PRP or Lead PRP's Representative for verification.
- E. The time elapsing from the time water is added to the mix until the concrete is deposited in place at the site of the work shall not exceed 30 minutes if concrete is hauled in non-agitating trucks, nor shall it exceed 90 minutes when hauled in transit-mix trucks or truck agitators.
- F. The addition of water after the completion of the initial mixing operation will not be permitted, except when concrete is delivered in transit mix trucks. In this case water may be added to the batch materials and additional mixing (at minimum 20rpm) may be performed to modify the consistency to meet specified requirements, provided that all of these operations are performed within 45 minutes after the initial mixing operation and the mixing speed of 20 rpm is not exceeded. Concrete that is not within specified consistency limits at the time of placement shall not be used.

### **3.02 MIXING CONCRETE**

- A. Submit information on mixing equipment. Mixers may be of the stationary plant, paver, or truck mixer type. Adequate equipment and facilities shall be provided for accurate measurement and control of all materials and for readily changing the proportions of the material.
- B. The mixing equipment shall be capable of combining the aggregates, cement, and water within the specified time into a thoroughly mixed and uniform mass and of discharging the mixture without segregation.
- C. Concrete mixing plant and equipment shall be maintained in good working order and shall be operated at the loads, speeds, and timing recommended by the manufacturer or as specified.
- D. The cement and aggregate shall be proportioned by weight.
- E. The concrete shall be mixed in a batch mixer until there is a uniform cement and aggregate shall be proportioned by weight distribution of the materials, and shall be discharged completely before the mixer is

recharged. For job-mixed concrete, the mixer shall be rotated at the speed recommended by the manufacturer and mixing shall be continued as follows for various sizes of mixers:

1. 1/2 cubic yd mixer or smaller at 1-1/4 minutes
  2. 3/4 to 1-1/4 cubic yd mixer at 1-1/2 minutes
  3. Larger than 1-1/4 cubic yd mixer at 2 minutes
  4. For each additional cu yd over 2 cu yd add 1/4 minutes
- F. The ready-mixed concrete shall be mixed and delivered in accordance with the requirements of "Standard Specifications For Ready-Mixed Concrete" ANSI/ASTM C-94 or as modified by these specifications. During a continuous pour, the interval between loads shall not be greater than 20 minutes, or in any case be so great as to allow the concrete in place to become partially hardened. Water used to flush the mixer or agitator between loads shall not be allowed to become a part of any concrete in the work.
- G. The batch plant shall be capable of controlling the delivery of all material to within 1 percent by weight of the individual material. If bulk cement is used, it shall be weighed on a separate visible scale which will accurately register the scale load at any stage of the weighing operation from zero to full capacity.
- H. Cement shall not come in contact with aggregate or with water until the materials are in the mixer ready for complete mixing with all mixing water. The procedure of mixing cement with sand or with sand and coarse aggregate for delivery to the jobsite for final mixing and addition of mixing water will not be permitted. Retempering of concrete will not be permitted. The entire batch shall be discharged before recharging. The volume of the mixed material per batch shall not exceed the manufacturer's rated capacity of the mixer.
- I. Mixing shall be done in batch mixers of acceptable type. Each mixer shall be equipped with a device for accurately measuring and indicating the quantity of water entering the concrete, and the operating mechanism shall be such that leakage will not occur when the valves

are closed. Each mixer shall be equipped with a device for automatically measuring, indicating, and controlling the time required for mixing. This device shall be interlocked to prevent the discharge of concrete from the mixer before the expiration of the mixing period.

- J. Transit-mixed concrete shall be mixed and delivered in accordance with ASTM C 94. The total elapsed time between the addition of water at the batch plant and discharging the completed mix shall not exceed 90 minutes or shall the elapsed time at the jobsite exceed 30 minutes. Under conditions contributing to quick setting, the total elapsed time permitted may be reduced by the Lead PRP. Each truck mixer shall be equipped with a device for counting the number of revolutions of the drum which device shall be interlocked so as to prevent the discharge of concrete from the drum before the required number of turns. After the drum is once started, it shall be revolved continuously until it has completely discharged its batch. Water shall not be admitted to the mix until the drum has started revolving. The right is reserved to increase the required minimum number of revolutions or to decrease the designated maximum number of revolutions allowed, if necessary, to obtain satisfactory mixing, and the Contractor will not be entitled to additional compensation because of such increase or decrease.
- K. When the temperature is below 40°F, adequate equipment shall be provided for heating the component materials of the concrete so that the concrete being deposited can be maintained at a temperature of 50°F minimum to 90°F maximum. When the air temperature is above 90°F, the temperature of the concrete being deposited shall not exceed 90°F, and adequate means of cooling the concrete mix shall be provided.
- L. Truck mixers shall be revolving-drum type and shall be equipped with a mixing water tank. Only the prescribed amount of mixing water shall be placed in the tank for any one batch, unless the tank is equipped with an approved device by which the amount of water added to each batch can be readily verified by the Lead PRP's Representative.
- M. Delivery tickets shall be prepared for each load of ready-mixed concrete delivered. In the event a laboratory representative is designated to inspect the batching operation, he shall prepare the ticket. In the event no laboratory representative is required for the project, the

batch plant operator shall prepare the ticket. The drivers of the trucks shall deliver the tickets to the Lead PRP's Representative at the site at the time of delivery. The tickets shall contain the following information:

1. Number of yards delivered on this truck.
  2. Quantities of materials in the batch.
  3. The time at which the truck left the batching plant.
  4. The time at which the cement was added.
  5. The outdoor temperature in the shade.
  6. The numerical sequence of the delivery.
  7. The Date.
- N. Hand mixed concrete shall be prepared on a watertight level platform in batches of not to exceed 1/3 cubic yard each. The required amount of coarse aggregate shall first be spread on the platform in an even and uniform layer, over which the proper proportion of fine aggregate shall then be likewise spread. The combined depth of both such layers shall not be greater than 1 foot. The required quantity of cement shall then be evenly distributed over the fine aggregate; following which the entire batch shall be turned with shovels at least twice before the water is added. The proper amount of water shall then be uniformly sprinkled or sprayed over the batch which shall thereafter be turned with shovels not less than three times before being removed from the platform.

### **3.03 PLACING CONCRETE**

- A. No concrete shall be placed without the prior authorization of the Lead PRP.
- B. The Contractor shall submit a proposed sequence of placing concrete showing proposed beginning and ending of individual placements. After acceptance, this sequence shall be adhered to except when

specific changes are requested by the Contractor and accepted by the Lead PRP.

- C. The Contractor shall notify the Lead PRP by written memorandum of his readiness (not just his intention) to place concrete in any portion of the work. This notification shall be such time in advance of the operation as the Lead PRP deems necessary for him to make final inspection of the preparations at the location of the proposed concrete placing. All forms, steel, screeds, anchors, ties, and inserts shall be in place before the Contractor's notification of readiness is given to the Lead PRP.
- D. No concrete shall be placed if the subgrade is muddy or soft.
- E. No concrete shall be placed during rainstorms or high velocity winds. Concrete placed immediately before rain shall be protected to prevent the water from coming in contact with it or winds causing excessive drying. Sufficient protective covering shall be kept on hand at all times for protection purposes.
- F. Placing of the concrete shall be done in accordance with ANSI/ACI 304, "Recommended Practice For Measuring, Mixing, and Placing Concrete", except as modified or revised by these specifications.
- G. Placement of concrete in which initial set has occurred or of retempered concrete will not be permitted.
- H. Before depositing concrete all debris shall be removed from the space to be occupied by the concrete. Forms, if constructed of lumber, shall be thoroughly wetted, except in freezing weather. Reinforcement, pipe sleeves and other materials to be embedded in the concrete shall be thoroughly secured in position. Water shall be removed from the space to be occupied by the concrete before concrete is deposited.
- I. Concrete shall be handled from the transporting vehicle in such a way as to prevent the separation or loss of the ingredients. Under no circumstances shall concrete that has partially hardened be deposited in the work. Concrete shall be deposited in the forms as nearly as practicable in its final position to avoid re-handling. It shall be so



deposited as to maintain, until the completion of the unit, a plastic surface approximately horizontal.

- J. Where concrete is conveyed to chutes, the equipment shall be of such size and design as to insure a continuous flow in the chute. The chutes shall be of metal, or metal-lined, and if two or more lengths are used, they shall have approximately the same slope. The slope shall not be less than 1 vertical to 2 horizontal and shall be such as to prevent the segregation of the ingredients. The discharge end of the chute shall be provided with a baffle plate to prevent segregation. If the distance of the discharge end of the chute above the surface of the concrete is more than 3 times the thickness of the layer being deposited, or more than 4 ft above the surface of the concrete, a spout or "elephant trunk" shall be used and the lower end maintained as near to the surface of deposit as practicable. When the operation is intermittent, the chute shall discharge into a hopper. The chute shall be thoroughly cleaned before and after each run and the debris from any water used shall be discharged outside the forms.
- K. Concrete shall be deposited at or near its final position to avoid segregation caused by rehandling or flowing. Concrete shall not be deposited in large quantities in one place and worked along the forms with the vibrator or otherwise. No concrete shall be dropped freely into place from a greater height than 5 feet. Tremies shall be used for placing concrete where the drop is over 5 feet. Placement of concrete on slopes shall commence at the bottom of the slope.
- L. If more than 20 minutes lapse prior to placement of new concrete over concrete previously placed, the depth of the layers being placed at one time shall be reduced, and/or placing equipment increased, until it is possible to return with the placing operation to previously placed concrete within 20 minutes. If concrete is to be placed over previously placed concrete and more than 20 minutes have elapsed, then a layer of grout not less than 1/2 inch thick nor more than 1 inch in thickness shall be spread over the surface before placing the additional concrete.
- M. Concrete shall be placed in approximately horizontal layers not to exceed 24 inches in depth and shall be brought up evenly in all parts of the forms. Concrete placement shall continue without avoidable

interruption, in a continuous operation, until the end of the placement is reached.

- N. The placement of concrete for slabs, beams, or walkways cast monolithically with walls or columns shall not commence until the concrete in the walls or columns has been allowed to set and shrink. The time allowed for shrinkage shall be not less than one hour.
- O. Before depositing new concrete on or against concrete which has hardened and to which it is to bond, the forms shall be re-tightened. The surface of the hardened concrete shall be roughened in a manner that will not leave loosened particles of aggregate or damaged concrete at the surface. It shall be thoroughly cleaned of foreign matter and laitance, and saturated with water.
- P. Consolidating Concrete
  - 1. Concrete during and immediately after depositing shall be thoroughly compacted by means of vibration.
  - 2. The number of vibrators used shall at all times be subject to the approval of the Lead PRP. Sufficient vibrators shall be on hand at all times to vibrate the concrete as placed. In addition to the vibrators in actual use while concrete is being placed, the Contractor shall have on hand one spare vibrator in serviceable condition. No concrete shall be placed until it has been ascertained that all vibrating equipment, including spares, is in serviceable condition
  - 3. The concrete shall be thoroughly worked around the reinforcement, and around embedded fixtures, and into the corners of the forms. The vibration shall be sufficiently intense to cause the concrete to flow and settle readily into place and to visibly affect the concrete over a radius of at least 18 inches. Attention is directed to the fact that manhole bottoms, pipe cradle and encasement, and similar concrete work are required to be thoroughly vibrated.
  - 4. Special care shall be taken to place the concrete solidly against the forms so as to leave no voids. Every precaution shall be

taken to make all concrete solid, compact, and smooth, and if for any reason the surfaces or interiors have voids or are in any way defective, such concrete shall be repaired in a manner acceptable to the Lead PRP.

- Q. The accumulation of water on the surface of the concrete due to water gain, segregation, or other causes, during placement and compacting, shall be prevented as far as possible by adjustments in the mixture. Provision shall be made for the removal of such accumulated water so that under no circumstances will concrete be placed in such accumulation.
- R. To minimize the formation of laitance, great care shall be exercised to disturb the concrete as little as possible while it is being deposited. Upon completion of a section of concrete, all laitance shall be entirely removed before work is resumed. The Contractor shall submit to the Lead PRP, prior to start of work, the details of procedures he proposes to minimize and control the development of shrinkage cracks.

#### **3.04 PLACING CONCRETE IN EXTREME WEATHER CONDITIONS**

- A. Concrete shall be placed in hot weather in accordance with "Hot Weather Concreting" (ACI 305) latest revision, except as modified or revised by these specifications.
- B. The Contractor shall submit information on the type of equipment to be used for heating materials and/or new concrete in the process of curing during excessively cold weather.
- C. For concrete placed below an ambient air temperature of 40 degrees F, or 45 degrees F and falling, provision shall be made for heating the water. If materials have been exposed to freezing temperatures to the degree that any material is below 35 degrees F, the material shall be heated. Water, cement, or aggregate materials shall not be heated in excess of 160 degrees F. Concrete in the forms shall be protected by means of covering with tarpaulins, or other acceptable covering, and a means shall be provided for circulating warm moist air around the forms to maintain a temperature of 50 degrees F for at least five days.

- D. For conditions which promote rapid drying of freshly placed concrete such as low humidity, high temperature, and wind, the Contractor shall take corrective measures to minimize the rapid water loss from the concrete. The Contractor shall submit the corrective measures he plans to use prior to placing concrete.
- E. The Contractor shall provide and use a sufficient number of maximum and minimum self-recording thermometers to adequately indicate the temperature around the concrete.

### **3.05 FOOTINGS AND SLABS ON GRADE**

- A. Concrete to be placed on ground or compacted fill shall not be placed until the subgrade is in a moist condition acceptable to the Lead PRP. If necessary, the subgrade shall be well sprinkled with water not less than 6 nor more than 20 hours in advance of placing concrete. If it becomes dry prior to the actual placing of concrete, it shall be sprinkled again, without forming pools of water. No concrete shall be placed if the subgrade is muddy or soft.

### **3.06 REPAIR OF DEFECTS**

- A. If after stripping of forms any concrete is found to be not formed as shown on the drawings, out of alignment or not level, or shows a defective surface, it shall be considered as not conforming with the intent of these specifications and shall be removed and replaced by the Contractor at his expense unless the Lead PRP grants permission to patch the defective area, in which case patching shall be done as hereinafter described.
- B. No defective work shall be patched, repaired, or covered without inspection by the Lead PRP. Repair shall have strength equal or greater than the specified concrete for the area. The Contractor shall submit a mix design for the grout which is proposed for use. All imperfections in the work shall be chipped out and keyed ready for repair.
- C. Defects that require replacement or repair are those that consist of honeycomb, damage due to stripping forms, loose pieces of concrete, surface holes caused by bolts and ties, excessive ridges at form joints

and bulges due to movement of the forms. Ridges and bulges shall be removed by chipping, tooling or grinding on finished surfaces. Honeycomb and other defective concrete shall be chipped out, and the chipped openings having sharp edges shaped so that the mortar filling will be keyed in place. All holes shall be kept thoroughly moistened for several hours before mortar filling is placed. The area to be patched shall be filled with the specified repair material.

- D. Imperfections, bolt and tie-rod holes, and chipped-out honeycomb areas to be repaired shall be filled with dry-patching mortar composed of 1 part of Portland cement to 2 parts of regular concrete sand (volume measurement) and just enough water so that after the ingredients are mixed thoroughly the mortar will stick together on being molded into a ball by slight pressure of the hands, and will not exude free water.
- E. The Contractor shall take care in filling rod and bolt-holes so that the entire depth of the hole is completely filled with compacted mortar. "EMBEKO", Five Star, or approved equal, shall be added to all patching mortar in an amount as recommended by the manufacturer for the mix to be used except for unpainted, exposed surfaces, or surfaces which are specified to be waterproofed or damp-proofed with a chemical-type protective coating. For surfaces on which the chemical-type protective coatings are specified, only materials recommended by the coating manufacturer shall be used for repairs.
- F. The mortar method of replacement shall be used for holes too wide to dry pack and too shallow for concrete replacement and shall be used for comparatively shallow depressions, large or small, which extend no deeper than the reinforcement nearest the surface. Mortar repairs shall be placed in thin layers and thoroughly compacted by suitable tools.
- G. Materials for exposed surfaces not requiring painting or waterproofing shall not cause discoloration of the proposed patch or the surrounding concrete surfaces. All honeycomb areas, bolt-holes and other imperfections shall be repaired with Master Builders, Cleveland, OH, "Set 45" or U.S. Grout Corporation, Old Greenwich, CT, Five Star structural concrete, or an approved equal which shall be installed according to the manufacturer's recommendations.

## **END OF SECTION**

**SECTION 03100**  
**CONCRETE FINISHING**

**PART 1      GENERAL**

**1.01   SCOPE**

- A.      This section shall describe how the Contractor shall perform work in regard to concrete finishing.

**1.02   REFERENCED SECTIONS – NONE**

**1.03   CITED STANDARDS – NONE**

**1.04   NOTED RESTRICTIONS – NONE**

**1.05   QUALITY CONTROL**

- A.      All concrete surfaces shall be finished by experienced finishers, as specified, as soon after placing the concrete as conditions will permit. The placing of concrete and the removal of forms shall be scheduled so that finishing the surfaces can be completed before the concrete reaches a final hard set. No cement plaster or cement brush-coats will be acceptable.
- B.      Unformed concrete surfaces shall be struck off to established grade and floated with a wood float until all irregularities are removed. Where required the surface shall then be troweled either with a wood trowel or a steel trowel, depending on the finish requirement of the area to be troweled, until a smooth dense finish is obtained. Troweling of the floated surface shall not be done until all excess water has evaporated.

**PART 2      PRODUCTS**

**2.01   SEALER**

- A.      Where specified, the sealer shall be Conspec #1, or Thomson's Water Seal 201 applied at a rate of 300 square feet per gallon for each coat.

**PART 3      EXECUTION**

**3.01   PREPARATION - NONE**

03100-1

### **3.02 INSTALLATION**

- A. Concrete surfaces shall be finished as indicated on the Drawings. Where not specified or indicated on the Drawings, the surfaces shall be finished as follows:
- B. Concrete surfaces which are specified or indicated to be painted, and all concrete surfaces, interior or exterior, exposed to view shall have fins removed and joints ground smooth, and shall be "sacked" with cement mortar so that all pits and holes are filled. Surfaces in open channels, basins, and similar structures, which are normally below the water surface shall have fins removed, but need not have joints ground. However, surfaces in such locations which are above the normal water surface and exposed to view shall have fins removed and joints ground smooth, and shall be "sacked" with cement mortar so that all pits and holes are filled. Concrete surfaces in closed boxes or channels where there is normally no access or passageway shall have the fins removed. All form ties shall be removed from all surfaces, and holes shall be filled after being cleaned and roughened by heavy sandblasting.
- C. The following surfaces shall be troweled, then given a light hairbroom finish:
  - 1. Tops of exterior walls or beams which are to support grating
- D. The following surfaces shall be screened off to grade and left rough:
  - 1. Projecting footings which are to be covered with dirt
  - 2. Slab surfaces which are to be covered with concrete fill or equipment pads
- E. The following surfaces shall receive a smooth steel trowel finish:
  - 1. Tops of corbels
  - 2. Tops of walls and beams not covered above
  - 3. Tops of all slabs not covered above herein
  - 4. All other surfaces not specified to be finished otherwise

- F. The final steel trowel finish shall be uniformly smooth and free of all irregularities. Building and machine room floors which are not to be covered with surfacing material shall be free from trowel marks. Trowel marks will be permitted in other locations. Concrete floor surfaces to which a surfacing material is to be applied shall be finished level and smooth with a tolerance of not over 1/8 inch in 10 feet in any direction.

### **3.02 CONCRETE SEALER**

- A. The following floors and slabs shall be sealed:
1. All exterior slabs.
  2. Sealant shall be applied to any and all other floor slabs, except those to receive a seamless floor surfacing or any slab which will receive epoxy surfacing.
- B. Sealant shall be applied at a coverage not to exceed 300 square feet per gallon and shall be applied as soon as the slab or floor will bear weight. The entire surface to be sealed shall be swept clean with a very soft bristled brush which will not mark the finish. The sealer shall then be applied with a large, clean, sheepskin mop type applicator. Paint rollers are not acceptable. Workmen shall wear flat soled shoes which will not mark or scar the surface.
- C. Apply two (2) coats of concrete sealer on top surfaces of the concrete floor. Sealer shall be clear of color and non-staining. The sealer shall be Conspec #1, or Thomson's Water Seal 201 applied at a rate of 300 square feet per gallon for each coat.
- D. No traffic shall be allowed on floors and slabs until sealer has dried and hardened.

**END OF SECTION**



**SECTION 03110**  
**CONCRETE CURING**

**PART 1      GENERAL**

**1.01   SCOPE**

- A.      This section shall describe how the Contractor shall perform work in regard to concrete curing.

**1.02   REFERENCED SECTIONS – NONE**

**1.03   CITED STANDARDS**

- A.      Concrete curing shall conform to the following or latest revisions of as applicable:
  - 1.      ASTM C171 - 07 Standard Specification for Sheet Materials for Curing Concrete
  - 2.      ASTM C309 - 07 Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete

**1.04   NOTED RESTRICTIONS – NONE**

**1.05   QUALITY CONTROL**

- A.      Protection against loss of moisture from the surface of the concrete shall be accomplished by the following:
  - 1.      Keeping the surface cured for a minimum period of 7 days.
  - 2.      Keeping the surface in contact with the form.
  - 3.      Covering with burlap or cotton mats kept continuously wet and covered with polyethylene plastic.
  - 4.      Continuously sprinkling the exposed surfaces.
  - 5.      Applying a curing and sealing compound as specified herein.

## **PART 2      PRODUCTS**

### **2.01    CURING AND SEALING COMPOUND**

- A.    Compound shall be "Super Aqua Cure VOX" or "Super Diamond Clear VOX" by The Euclid Chemical Co. or an equal approved by the Lead PRP or Lead PRP's Representative.
- B.    Clear Curing and Sealing Compound (VOC compliant) shall comply with ASTM C309, Type 1D. The compound shall have 30 percent solids content minimum, and will not yellow under ultraviolet light after 500 hours of test and will have test data from an independent testing laboratory indicating a maximum moisture loss of 0.040 grams per sq cm when applied at a coverage rate of 300 sq ft per gallon.
- C.    No curing compounds shall be used on any surfaces to which pneumatic mortar is to be applied, or on which any other type of concrete mortar or chemical waterproofing coating is to be used. They may be used in other places, however, upon the approval of the compound and its location by the Lead PRP.

## **PART 3      EXECUTION**

### **3.01    PREPARATION – NONE**

### **3.02    INSTALLATION**

- A.    All concrete shall be cured by the methods specified herein for a minimum of seven days.
- B.    All concrete that is to be painted shall be water or plastic membrane cured. No curing compound shall be used on any concrete surface that is to receive paint or upon which any material is to be bonded. All other concrete shall be cured by water curing or sprayed curing membrane at the Contractor's option, except floors and slabs which are specified to be sealed with a concrete sealer. Floor slabs may be cured using a plastic film membrane curing.
- C.    Water Curing

1. All surfaces of concrete being water cured shall be kept constantly and visibly moist day and night for a period of not less than seven days and nights. Each day the forms remain in place may count as one day of water curing. No further curing credit will be allowed for forms in place after contact has once been broken between the concrete surface and the forms. Ties shall not be loosened during the period when concrete is being cured by leaving the forms in place. The top of walls shall be flooded with water at least three times per day, and the concrete surface shall be kept moist at all times during the seven day curing period.

D. Sprayed Membrane Curing

1. The curing compound shall be applied to the concrete surface after repairing and patching, and within one hour after the forms are removed. If more than one hour elapses after the removal of the forms, membrane compound shall not be used and water curing shall be applied for the full curing period. If the surface requires repairing or painting, the concrete shall be water cured.
2. Curing compound shall not be removed from the concrete in less than seven days. Curing compound may be removed by the Contractor only upon written request by the Contractor and acceptance by the Lead PRP, stating what measures the Contractor shall take to adequately cure the structure.
3. Care shall be taken to apply curing compound in the area of the constructions joints to see that curing compound is placed within the construction joint silhouette. The curing compound placed within the construction joint silhouette shall be removed by heavy sandblasting prior to placing any new concrete. The Contractor has the option of water curing the construction joint.
4. Curing compound shall be applied by a mechanical, power operated sprayer and mechanical agitator that will uniformly mix all pigment and compound. The compound shall be applied in at least two coats. Each coat shall be applied in a direction opposite to the preceding coat.

5. The compound shall be applied in sufficient quantity so that the surface will have a uniform appearance and will effectively and completely conceal all natural color of the concrete at the time of the spraying. The Contractor shall continue to coat and recoat the surface until the specified coverage is achieved and until a coating film remains on the surface of the concrete. The thickness and coverage of the compound shall be such that the film can be scraped from the surface at any and all points after drying for at least 24 hours.
6. The Contractor is cautioned that the method of applying curing compound specified herein may require more compound than normally suggested by the manufacturer of the compound and also more than is customary in the trade.
7. If the Contractor desires to use a curing compound other than the specified compound, the Contractor shall coat sample areas of concrete wall with the proposed compound and also a similar adjacent area with the specified compound in the specified manner for comparison. Complete data on the proposed compound shall also be submitted for review. If the proposed sample is not equal or better, in the opinion of the Lead PRP, in all features, the proposed substitution will not be allowed.
8. Prior to final acceptance of the work, the Contractor shall remove, by sandblasting or other acceptable method, any curing compound on surfaces that will be exposed to view, so that only the natural color of the finished concrete will be visible uniformly over the entire surface.
9. When concrete slab placements are subject to high temperatures, wind and/or low humidity, the Lead PRP or the Lead PRP's Representative may require the use of the evaporation retarder to minimize plastic cracking. The compound may be required to be applied one or more times during the finishing operation.
10. At air temperatures of 90°F or above, concrete shall be kept below 90°F during placing and curing. Concrete surfaces shall be kept continuously moist by wet-curing for at least 24 hours

after the concrete has been placed, and water shall be applied to formed surfaces while forms are still in place. After the period of wet-curing, a suitable heat-reflecting plastic membrane or white-pigmented curing compound or immediate membrane curing shall be used.

E. Plastic Membrane Curing

1. Polyethylene film may be used to cure slabs, and shall be sealed at joints and edges with a small sand berm. The plastic membrane shall be installed as soon as the concrete is finished and can be walked on without damage. The concrete shall be kept moist under the plastic membrane.

**3.03 TESTING – NONE**

**END OF SECTION**

## **SECTION 03120**

### **NON-SHRINK GROUTING**

#### **PART 1 GENERAL**

##### **1.01 SCOPE**

- A. The Contractor shall furnish all material, equipment, labor, services, etc., for grouting as specified in this section and the respective drawings.

##### **1.02 REFERENCED SECTIONS – NONE**

##### **1.03 CITED STANDARDS – NONE**

- A. All non-shrink grouting shall conform to the following standards or latest revisions of as applicable:
  - 1. ASTM C109 – Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or [50-mm] Cube Specimens)
  - 2. ASTM C157 / C157M - 08 Standard Test Method for Length Change of Hardened Hydraulic-Cement Mortar and Concrete
  - 3. ASTM C191 - 08 Standard Test Methods for Time of Setting of Hydraulic Cement by Vicat Needle
  - 4. ASTM C827 - 01a(2005) Standard Test Method for Change in Height at Early Ages of Cylindrical Specimens of Cementitious Mixtures
  - 5. Corps of Engineers CRD C-621 – Specification for Non-Shrink Grout

##### **1.04 NOTED RESTRICTIONS**

- A. In no case shall the water/cement ratio be more than that specified for the concrete being repaired. In the case of mortar being used for patching or repairing exposed concrete surfaces which are not to be painted or which will not be submerged in water, sufficient white

cement shall be used to make the color of the finished patch match that of the surrounding concrete.

## **1.05 QUALITY CONTROL**

- A. The Contractor shall assure compliance with applicable standards.
- B. Non-shrink grout shall be made with a hydraulic cement, which when mixed with water, will harden rapidly to produce a permanent high strength material suitable for exterior use.

## **PART 2 PRODUCTS**

### **1.06 GENERAL**

- A. Cement mortar or grout for the repair of imperfect concrete work, filling of holes left by form bolts or ties, and the filling of voids around items through the concrete, and grout for spreading over construction joints and cold joints etc., shall consist of Portland cement and sand mixed in the same proportions used for the concrete being repaired, with only sufficient water to give the required consistency. Essentially, this would consist of the concrete mix with the coarse aggregate removed and water quantity adjusted as required.
- B. In no case shall the water/cement ratio be more than that specified for the concrete being repaired. In the case of mortar being used for patching or repairing exposed concrete surfaces which are not to be painted or which will not be submerged in water, sufficient white cement shall be used to make the color of the finished patch match that of the surrounding concrete.
- C. Grout to fill the void between the steel casing and the carrier pipe of jacked pipe shall have the concrete mix of Class C concrete with the coarse aggregate removed.
- D. Grout for which the mix is not otherwise specified shall be mixed in the proportions by weight of one part cement to four parts of concrete sand.

### **2.02 NON-SHRINK GROUTING**

- A. Nonshrink grout shall be made with a hydraulic cement, which when mixed with water will harden rapidly to produce a permanent high strength material suitable for exterior use. Nonshrink grout shall be nonmetallic and shall not contain calcium chloride or other chemicals which accelerate the corrosion of embedded steel. The grout shall show no shrinkage prior to initial setting in accordance with ASTM C 827 and shall show no shrinkage in the hardened state when tested in accordance with ASTM C 157 and Corps of Engineers CRD C-621. Nonshrink grout shall be Five Star Grout manufactured by U.S. Grout Corporation; Masterflow 713 Grout manufactured by Master Builders; or equal.
- B. When mixed in accordance with manufacturer's published instructions, the nonshrink grout shall be semi-fluid and suitable for placing by pouring into place when mixed to a flowable consistency. The compressive strength tested in accordance with ASTM C 109 shall be not less than 3,000 psi at 1 day and not less than 6,000 psi at 28 days. Setting time tested in accordance with ASTM C 191 shall be not less than 30 minutes.

## **2.03 EPOXY GROUT**

- A. Epoxy grout shall be made by mixing one part epoxy with not more than two parts sand. The sand shall be clean, bagged, graded, kiln dried silica sand. The prepared grout shall wet the contact surface and provide proper adhesion or a coat of epoxy shall be applied prior to placing the epoxy grout. Manufacturer's published instructions for mixing and application shall be followed.

## **PART 3 EXECUTION**

### **3.01 PREPARATION**

- A. Bolt and tie holes shall be cleaned and roughened by heavy sandblasting and filled with dry-pack mortar, well tamped into the holes. For dry-pack mortar, only enough water shall be used so that the resulting mortar will crumble to the touch after being formed into a ball by hand.



- B. Concrete surfaces shall be cleaned and roughened by a heavy sandblasting and thoroughly damp before grout or mortar is placed, or, where indicated on the Drawings or specified, an epoxy bonding agent shall be applied to the clean, roughened, dry surface before placing the mortar or grout.

### **3.02 INSTALLATION**

- A. Grout for spreading over the surfaces of construction joints or cold joints shall consist of sand and cement with no more water used than allowed by the water/cement ratio specified for the concrete.
- B. Particular care shall be exercised in placing cement mortar or grout since it will be expected to furnish structural strength or an impermeable water seal or both. Cement mortar or grout that has not been placed within 30 minutes after mixing shall not be used.
- C. Epoxy grout shall be used where specified herein or where indicated on the Drawings. Epoxy grout may be used to repair surface defects in concrete work.
- D. For vertical or overhead work, epoxy gel shall be used. For horizontal work, epoxy shall be used. Epoxy grout for vertical or overhead work may be used for horizontal work.

### **3.03 TESTING – NONE**

**END OF SECTION**

# **DIVISION 4 – PROCESS INTEGRATION**

## **SECTION 04050**

### **COMMON WORK RESULTS FOR PROCESS INTEGRATION**

#### **PART 1 – GENERAL**

##### **1.01 GENERAL CONDITIONS**

- A. The General Conditions apply to all work of this Specification, which shall be done as shown on the plans, and as specified, and shall be properly coordinated with work in other Specifications.
- B. The Drawings and these Specifications are complementary to each other; what is called for by one shall be as binding as if called for by both. If there is any conflict between what is shown on the Drawings and what is written in the Specifications, the more restrictive shall take precedence and the Contractor shall communicate the conflicts to the CQA Consultant prior to constructing the work.
- C. Safety
  - 1. The Contractor shall be familiar with, and shall at all times conform to, the regulations of the “*OSHA General Industry Occupational Safety and Health Standards*,” “*OSHA Safety and Health Regulations for Construction*,” and other applicable state and municipal standards and regulations.
  - 2. Protection of Work Area
    - a. The Contractor shall be familiar with possible/potential utilities that may impact construction work, and plan work accordingly.
    - b. The Contractor shall verify the possible locations for all underground utilities before beginning excavation work for pipe installation.
    - c. The Contractor shall protect existing site improvements from damage during construction of underground pipeline.

**1.02 REFERENCED SECTIONS - NONE**

**1.03 CITED STANDARDS**

- A. For welding operations (where necessary), welders and operators shall perform work in accordance with the following, as applicable for all piping work:
  - 1. ASME B31.1 / B31.3 Power and Process Piping Package
  - 2. ASME B31.9 - Working Pressure and Temperature Limits
- B. For brazing procedures (if necessary), procedures, brazers, and operators shall be certified in accordance with the following, as applicable for shop and job-site brazing of piping work:
  - 1. ASME Boiler and Pressure Vessel Code, Section IX,

**1.04 NOTED RESTRICTIONS**

- A. SAE Grade 5 zinc coated bolts shall be used for above-ground flange joints. Threads shall be coated with an anti-seizing compound before nut installation.
- B. Buried flange joints shall be 316 Stainless Steel per ASTM F593-95 with an 85,000 psi average tensile strength. Threads shall be coated with an anti-seizing compound before nut installation.

**1.05 QUALITY CONTROL**

- A. Manufacturers for piping shall be firms regularly engaged in manufacture of pipes and pipe fittings of types and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.
- B. Installer's Qualifications:
  - 1. Firm with at least 3 years history of successful experience on projects of similar nature.
  - 2. Licensed as a firm in the contractor state of origin and in the state of Illinois.

C. Welding Certification:

1. Each welder shall have passed a qualification test within the past six months.
2. The test shall be in accordance with the ASME Boiler and Pressure Vessel Code, Section IX, "Welding Qualifications", ASME Section VIII, and ANSI 313.
3. The test report shall certify that the welder is qualified to weld the material to be used at the job site.
4. The Contractor shall submit three copies of each welder's qualification test report to the CQA Consultant for approval prior to commencing the work. No welder shall be used on the project until so certified.

**1.06 SUBMITTALS**

- A. Product Data: Submit manufacturer's technical product data, installation instructions, and dimensioned drawings for each type of pipe and pipe fitting. Submit piping schedule showing manufacturer, pipe or tube weight, fitting type, and joint type for each piping system.
- B. Welding Certifications: Submit reports as required for piping work.
- C. Brazing Certifications: Submit reports as required for piping work.
- D. Maintenance Data: Submit maintenance data and parts lists for each type of mechanical fitting. Include this data, product data, and certifications in maintenance manual; in accordance with requirements of Section 01300.

**1.07 DELIVERABLES**

- A. Except for concrete, corrugated metal, hub-and-spigot, clay, and similar units of pipe, provide factory-applied plastic end-caps on each length of pipe and tube. Maintain end-caps through shipping, storage and handling as required preventing pipe-end damage and eliminating dirt and moisture from inside of pipe and tube.

- B. Where possible, store pipe and tube inside and protected from weather. Where necessary to store outside, elevate above grade and enclose with durable, waterproof wrapping.
- C. Protect flanges and fittings from moisture and dirt by inside storage and enclosure, or by packaging with durable, waterproof wrapping.

**PART 2- PRODUCTS – NOT USED**

**PART 3- EXECUTION**

**3.01 TESTING**

- A. When the Contractor considers his/her work has reached final completion, the Contractor shall perform an overall system performance test to show that there is a complete and functional system. The Contractor shall pump a minimum of one tank volume of water from each underground tank to above ground tank and pump the combined water to a truck to be hauled to Rock River Water Reclamation District by others. Problems identified during the system performance testing shall be fixed by the Contractor at no additional cost to the Lead PRP.

**END OF SECTION**

## **SECTION 04060**

### **FLUSHING AND DISINFECTION OF PIPING**

#### **PART 1- GENERAL**

##### **1.01 SECTION INCLUDES**

- A. This Section includes flushing and disinfection of all pressure pipelines, Leachate Collection Pipe, Leachate Transmission Pipe, and testing of all pipelines. The Contractor shall flush and test all pipelines as per the Specifications contained herein.

##### **1.02 REFERENCED SECTIONS**

- A. Related Sections
  - 1. Section 04070- Leak Testing of Piping

##### **1.03 CITED STANDARDS**

- A. National Electrical Code Section NFPA 70.

##### **1.04 NOTED RESTRICTIONS**

- A. The minimum flushing velocity will be 5.0 fps.

##### **1.05 QUALITY CONTROL**

- A. Each pipeline shall be flushed in accordance with these procedures and, tested as per the general requirements of this section and more specific testing procedures in following sections.
- B. Flushing
  - 1) The backflow device and metered connection to the potable supply will be sized to meet the minimum flow requirement based on 5.0 fps.
- C. Testing shall be performed in accordance with the Specifications in Section 04070.

##### **1.06 SUBMITTALS**

- A. A written plan for proper flushing and testing of each pipeline shall be submitted to the CQA Consultant for approval prior to start of work. The plan will address how the Contractor will meet the requirements of this specification. At a minimum, it will include:
1. Schematic map(s) of the project showing points of connection and flushing points.
  2. Mechanical flow diagram(s) marked to identify the boundaries of the test and valve line-up.
  3. A completed Hydrostatic and Pneumatic Test Data Sheet (Attachment 1 at the end of this Section) including pretest release signatures. Alternate Data Sheets shall be considered by the CQA Consultant.
  4. The type of pipeline being flushed and tested with a notation of whether it is above or below ground.
  5. Make and model number of backflow prevention device(s) and flow meter used to connect to the water system for flushing and testing.
  6. Calculations for sizing of source water connection(s), flushing velocities and total quantity.
  7. A detailed work schedule listing the approximate dates for each activity covered in this specification.
  8. Detailed procedures for each activity.
  9. NPDES permit and compliance procedures for flushing.
  10. Emergency contact information.
  11. Air relief plan showing all points of air bleeds
- B. The written plan for installation, flushing, testing, shutdowns, tie-ins, and activation will be submitted to the CQA Consultant two weeks prior and returned to the Contractor one week prior to the activity.

## **PART 2- PRODUCTS**

### **2.01 MATERIALS REQUIREMENTS**

- A. All temporary valves, temporary blow-offs, bulkheads, backflow devices, or other water control equipment and materials shall be determined and furnished by the Contractor. No materials shall be used which would be injurious to the pipeline or its future function.
- B. All pressurizing equipment and measuring devices required for testing shall be determined and furnished by the Contractor. No materials shall be used which would be injurious to the pipeline or its future function.

## **PART 3- EXECUTION**

### **3.01 GENERAL**

- A. Unless otherwise indicated, potable water for flushing and disinfection will be furnished by the Contractor. The Contractor shall furnish and install all materials including, but not limited to, approved backflow devices and also make all necessary arrangements for conveying the water to the points of use.
- B. All pressure pipelines shall be tested per the requirements of this division. Pump testing requirements are as stipulated in Division 5.

### **3.02 FLUSHING**

- A. As pipe laying progresses and at the conclusion of the work, thoroughly clean all of the new pipelines to remove all dirt, stones, pieces of wood or other material which may have entered during the construction period. Debris cleaned from the lines shall be removed from the job site. If, after this cleaning, any obstructions remain, they shall be removed.
- B. The Contractor shall flush each pressure pipeline, Leachate Transmission Pipe and Leachate Collection Pipe, at a minimum flushing velocity of 5.0 fps, utilizing potable water as per the written plan.
  - 1. The Contractor shall continue flushing for sufficient time to achieve two (2) exchanges of the total volume of the pipeline as a minimum and until the water flushed runs clear.



2. The Contractor is responsible for containing and disposing of flush water at Contractor expense and at no expense to the Lead PRP.
  3. Leak testing shall be conducted following flushing and shall be performed in accordance with the Specifications in Section 04070.
- C. Prior to substantial completion of the project, thoroughly clean, by means of high pressure water jetting, all of the proposed leachate collection and header pipe lines to remove all dirt, stones, pieces of wood or other material which may have entered during the construction period. If, after this cleaning, any obstructions remain, they shall be removed. Cleaning of the leachate collection and header pipes shall be conducted by a qualified Contractor experienced in working within landfill environments. All proposed and existing leachate pipes shall be completely cleaned as a requirement for substantial completion.

### **3.03 VIDEO INSPECTIONS**

- A. Prior to substantial completion, all proposed leachate collection and header pipes shall be subject to video camera inspection by the Contractor under the observation of the Engineer. It is the intent to video leachate pipes to locate pipe defects, deviations to gradient, and clogs. When this inspection is performed, the Contractor shall be responsible for preparing the pipes for inspection and furnishing labor as required at no expense to the Owner. Video inspections of the leachate collection and header pipes shall be conducted by a qualified Contractor experienced in working within landfill environments. Color video recordings, in digital format (DVD), of the leachate pipes shall be provided to the Owner as a permanent record. Each video recording shall have an audio and written log of that video recording's contents.
- B. Video camera system shall be capable of accessing the leachate collection and header lines from the proposed and existing cleanouts. Video camera equipment utilized to inspect the existing leachate pipes must comply with the requirements of Class 1, Division 1 Groups C&D of the National Electrical Code Section NFPA 70.

- C. The recordings shall be properly exposed and the camera shall be in proper focus so that good, clear recordings showing detail are produced. Recordings shall be identified on the audio track noting the leachate pipe, any leaks, cracks, or pipe defects. Video recordings, in digital format (DVD) (original and one copy) of the completed leachate pipes shall be delivered to the Owner. The Contractor shall provide any assistance required by the Owner to assist the Owner with visual inspections.

**END OF SECTION**

## **SECTION 04070**

### **LEAK TESTING OF PIPING**

#### **PART 1- GENERAL**

##### **1.01 SECTION INCLUDES**

- A. This specification identifies the minimum requirements for leak testing of all piping performed by the Contractor.

##### **1.02 REFERENCED SECTIONS**

- A. Related Sections are below.
  - 1. Section 04050 - Common Work Results For Process Integration

##### **1.03 CITED STANDARDS – NONE**

##### **1.04 NOTED RESTRICTIONS**

- A. Leak testing shall be limited to 1,000 foot intervals or between isolation valve locations, whichever is the shorter distance.
- B. Changes in temperature will increase or decrease the apparent test pressure in any piping system. The effect depends on the rate of expansion of the pipe wall compared to the water in the pipe. When possible, testing should be done during periods of relatively stable atmospheric temperatures. Early mornings and late afternoons are good times to test the pipe when it has not been buried.
- C. Under no circumstances shall the total time under the test exceed eight (8) hours at 1.5 times the pressure rating of the lowest rated component in the system. If the test is not completed due to leakage, equipment failure, etc., the test section shall be allowed to “relax” for eight (8) hours prior to the next test.

##### **1.05 QUALITY CONTROL**

- A. The Contractor shall perform hydrostatic testing of all single-walled piping and the inner pipe of double-walled piping.
- B. The Contractor shall conduct pneumatic leak testing on the secondary containment piping of the double walled HDPE pipeline and instruments, tubing and connections operating with an air or gaseous media.

- C. The Contractor shall develop detailed procedures for leak testing based on the minimum requirements of this specification, and manufacturer's instructions. All leak testing procedures shall be submitted to the CQA Consultant for review and approval.
- D. All leak testing shall be witnessed by the CQA Consultant.
- E. In general, service leak testing shall be conducted on the following systems:
  - 1. all equipment, equipment connections and pipelines.
  - 2. Instruments and instrument tubing connections to equipment, piping, or ducting.
  - 3. Flanges or other connections temporarily blinded or capped for hydrostatic or pneumatic testing.
- F. Requirements Prior to Testing
  - 1. Before testing, the pipe trench shall be backfilled with a minimum of six inches of material, or center loaded to hold the pipe in place while testing.

## **1.06 SUBMITTALS**

- A. The Contractor shall submit detailed leak testing procedures for the CQA Consultant's review and approval two weeks prior to the start of leak testing.

## **PART 2- PRODUCTS**

### **2.01 GENERAL**

- A. All temporary test gauges, fittings, hoses, valves, pumps, compressors, test media, relief devices, and leak inspection materials, including soap solutions, shall be specified and provided by the Contractor.
- B. Any replacement piping components required to repair leaks, shall be provided by the Contractor at no additional cost to the Lead PRP.
- C. Water

1. Make-up water for testing shall be potable water.

**D. Test Bulkheads**

1. Design and fabricate test bulkheads per Section VIII of the ASME Boiler and Pressure Vessel Code. Materials shall comply with Part UCS of said code. Design pressure shall be at least 2.0 times the specified test pressure for the section of pipe containing the bulkhead. Limit stresses to 70 percent of yield strength of the bulkhead material at the bulkhead design pressure. Include air-release and water drainage connections.

**E. Vents and Drain for Aboveground Piping**

1. Install vents on the high points of aboveground piping, whether shown on the Drawings or not. Install drains on low points of aboveground piping, whether shown on the Drawings or not. Provide a valve at each vent or drain point. Valves shall be 3/4-inch for piping 3 inches and larger and 1/2-inch for piping smaller than 3 inches.

**F. Manual Air-Release Valves for Buried Piping**

1. Provide temporary manual air-release valves for pipeline test. Construct the pipe outlet in the same manner as for a permanent air valve and after use, seal with a blind flange, pipe cap, or plug and coat equal to the adjacent pipe.

**2.02 TESTING EQUIPMENT**

**A. The Contractor shall provide all equipment required for hydrostatic and pneumatic testing, including, but not limited to:**

1. All fittings bleed points, pumps, flanges, connections, etc., necessary to perform hydrostatic test.
2. Clean water, with sufficient quantity to fill pipeline section under test.
3. A strainer on the inlet side of pump to prevent foreign matter from entering the pipeline.

4. Flange connections and/or valves suitable to isolate the pipeline section being tested without leaking.
5. A relief valve capable of permitting pressure relief if pressure exceeds 20 to 25 percent above required test pressure to prevent pipeline failure.
6. Testing pressure gauge(s)
  - a. Sufficient number of pressure gauges capable of measuring 50 percent over the intended test pressure. Pressure gauges shall be accurate within 1.0 percent.
  - b. Pressure gauges and relief valves shall be checked for accuracy prior to use during actual testing of the pipeline.
7. A booster pump with sufficient capacity to boost the source water pressure to the required test pressure.
8. An air compressor with sufficient capacity to provide air pressure to the required test pressure for the leak tests.

## **PART 3- EXECUTION**

### **3.01 GENERAL EXAMINATION**

- A. The system or portion of the system to be tested shall be verified to determine that the system is mechanically completed and the following requirements have been met:
  1. All solvent welded or bonded joints have cured for at least 8 hours unless the ambient temperature is less than 70 degrees Fahrenheit (°F). If the ambient temperature is less than 70°F, the cure time shall be in accordance with the manufacturer's instructions.
  2. All welding has been completed, including the acceptance of all required nondestructive examinations on pressure retaining welds.
  3. All fusion joints have been completed, including the acceptance of all required nondestructive examinations on pressure-retaining welds.

4. All flanged connections have been completed, including bolting and gaskets.
  5. All expansion joints have been installed and suitably anchored or guided in accordance with the manufacturer's instructions.
  6. All nipples and valves have been installed for vents, drains, and instrument connections as specified on the applicable design Drawings.
  7. All anchors and supports have been placed as specified on the applicable design Drawings.
  8. All joints, including welds, bonds, and piping joints have been left uninsulated and/or unburied and exposed for examination during testing.
- B. Verification shall include a comparison of the system to be tested to the mechanical flow, piping, and other applicable design Drawings and the requirements of Section 04050 Common Work Results for Process Integration, as applicable.

### **3.02 GENERAL PREPARATION**

- A. The Contractor shall have a written plan, approved by the CQA Consultant, in place, and shall follow the requirements of the plan.
- B. Equipment or piping that is not to be tested shall either be disconnected or isolated by blinds or other means. A valve may be used in place of a blind if the valve is rated to the test pressure.
- C. Instrumentation shall not be installed prior to testing unless the instrument is vented.
- D. Sufficient vents and drains shall be located and installed by the Contractor to allow the removal of air.
- E. All temporary test connections shall be completed.
- F. If impractical to test in place and if specifically approved by the Lead PRP and the CQA Consultant, short runs or spools of piping may be interconnected and tested together.

- G. Check valve internals shall be disassembled if the direction of the check valve does not allow complete filling or depressurizing of the system.
- H. Booster pump(s) shall provide sufficient capacity to boost the source water pressure to the required test pressure.
- I. Prior to testing the pipeline shall be properly flushed.

### **3.03 HYDROSTATIC LEAK TESTING REQUIREMENTS**

- A. Hydrostatic leak tests shall conform to the requirements of this specification and the manufacturer's instructions.
- B. Tests shall be conducted after pipes are placed at their designed alignments and elevations.
- C. Test pressures for all piping systems shall not exceed 150% of the design pressure for the least-rated pipe, fitting, or valve installed in the system.
- D. Air vents shall be provided by the Contractor at high points in the system to ensure that all air is purged from the system during filling. The number and location of all high point air bleeds shall also be approved by the Engineer.
- E. The Contractor shall conduct a leak test on all installed piping. The Contractor shall also furnish all necessary equipment and materials, and make all taps in the pipe as required. The CQA Consultant shall be notified at least 72 hours in advance of testing.
- F. Drain valves shall be provided to facilitate filling and draining of all test liquid from the system. Drain valves may be omitted if the system is to operate liquid filled.
- G. Tests shall not be performed unless weather conditions ensure a dry surface on the system to be tested or suitable weather protection can be provided.
- H. Testing shall not commence until all sections of the pipeline to be tested have been secured to prevent damage to adjacent piping and equipment in the event of a joint failure. Any appurtenant instruments or devices that could be damaged by the test shall be removed from the piping or suitably



isolated prior to applying the test. The Contractor will be held responsible for any damage caused by the testing.

- I. During hydrostatic leak testing, joints shall be exposed for visual inspection. It is advised to cover the pipeline in intervals, especially at curves to hold the pipe in place during pressure testing.
- J. Expansion joints and/or expansion compensators shall be restrained, isolated, or removed during pressurized leak testing.
- K. All leaks identified shall be repaired and retested at no additional expense to the Lead PRP, including labor and replacement of any material. After repair, the system shall be retested.
- L. After testing, the Contractor shall remove all temporary blinds and remake all connections disassembled for the leak test.
- M. The pipe shall not be backfilled until visual inspection has been completed. Joints shall not be backfilled until successful completion of the leak test.

### **3.04 HYDROSTATIC LEAK TESTING PROCEDURE**

- A. The hydrostatic test procedure developed by the Contractor shall include the following provisions:
  - 1. Air vents shall be opened to allow elimination of air from the system.
  - 2. The tested pipeline shall be slowly filled (<1fps) with test fluid at the lowest point in the system. The Contractor shall provide means for increasing pressure to the required test pressures.
  - 3. The test section shall be completely filled with the test medium, taking care to bleed off any trapped air.
  - 4. When the tested pipeline is completely filled with the test fluid, the vents shall slowly be closed and line pressure shall slowly be brought up to the indicated test pressure.
  - 5. Piping shall be tested up to 150% of the max. operating pressure (MAOP) of the lowest-rated component of each specified line segment.

B. The primary system shall be pressure tested hydrostatically in the phases as follows:

1. Initial expansion phase: Pipe expansion-stabilization shall be conducted for a period of four (4) hours. Pipe shall be filled with water slowly and purged of all air before application of additional. If necessary, water is added to the pipe four times at one-hour intervals, to return the pipe to the specified pressure. Stabilization is achieved if there is no further reduction in pressure during the final one-hour period; this phase shall not exceed four (4) hours. The actual test may begin at this time even if stabilization has not been achieved; or, the pipe may be inspected for leaks, repaired if necessary and the expansion-stabilization phase restarted.
2. Actual test phase: Start the test at the end of the fourth hour of the expansion- stabilization phase. Add water to the pipe if necessary. Perform the hydrostatic test for up to three (3) hours: At the end of each hour, add make-up water to return the pipe to the test pressure, if necessary. A passing test is considered to require less than the cumulative make-up water listed in the table below with no visible leaks, after either hour 1, 2, or 3. If the added volume exceeds the cumulative table value after the third and final addition of make-up water, the test has failed. Inspect for evidence of leaking, repair as necessary, or take actions to minimize ambient temperature fluctuations, prior to repeating the expansion and test phases.

#### **ALLOWANCE FOR EXPANSION**

##### **UNDER TEST PRESSURE\***

Allowance for Expansion (U.S. Gallons / 100 Feet of Pipe)

<b>Nominal Pipe Size (in)</b>	<b>1 Hour Test</b>	<b>2 Hour Test</b>	<b>3 Hour Test</b>
3	0.10	0.15	0.25
4	0.13	0.25	0.40

6	0.30	0.60	0.90
8	0.50	1.0	1.5
10	0.75	1.3	2.1
11	1.0	2.0	3.0
12	1.1	2.3	3.4
14	1.4	2.8	3.2
16	1.7	3.3	5.0
18	2.2	4.3	6.5
20	2.8	5.5	8.0
22	3.5	7.0	10.5
24	4.5	8.8	13.3
28	5.5	11.1	16.8
32	7.0	14.3	215.0
36	9.0	18.0	27.0
40	11.0	22.0	33.0
48	15.0	27.0	43.0

Note: \*These allowances only apply to the test period and  
not to the initial expansion phase.

C. Procedures Following Results

1. Examination for leakage shall be made of all welds, joints, and connections.

2. If a pressure test fails, the pipe shall be relieved, and the test section allowed to "relax" for a minimum of 8 hours before another test is attempted.
3. Upon satisfactory completion of the test, the system shall be slowly depressurized and completely drained. Air vents shall be opened as required to prevent inducing a vacuum on the system.
4. Provisions shall be made to divert draining test fluid from excavated and trenched areas and to maintain well formed and supported excavations throughout the testing procedure.

**D. Test Records**

1. Records shall be made of each piping system installation during the test. These records shall include:
  - a. Date of test.
  - b. Description and identification of piping tested including a marked up plan and profile.
  - c. Starting test pressure and end pressure.
  - d. Summary of make-up water.
  - e. Remarks, to include leaks (type, location) and repairs made on leaks
  - f. Certification by the Contractor and signed acknowledgement by the CQA Consultant.

**3.05 PNEUMATIC LEAK TEST**

**A. General Requirements**

1. The Contractor shall conduct pneumatic leak testing on the secondary containment piping of the environmental pipeline (double walled HDPE pipeline) and instruments, tubing and connections operating with an air or gaseous media.

2. The inner pipe of double walled HDPE piping shall remain full of water throughout the pneumatic testing of the outer pipe to prevent collapsing.
3. Pneumatic leak tests shall conform to the requirements of this specification and ANSI B31.3. Pneumatic leak testing of double-contained piping shall also conform to the manufacturer's instructions. Special precautions for pneumatic leak testing are identified in ANSI B31.3.
4. Test pressures shall not exceed 5 psi.
5. A pressure relief device shall be provided with a set pressure that does not exceed 110 percent of the test pressure. Sizing and selection of the pressure relief device shall be determined by the Contractor.
6. Tests shall not be performed unless weather conditions ensure a dry surface on the system to be tested or suitable weather protection can be provided.
7. All leaks shall be repaired at no additional expense to the Lead PRP, including labor and replacement of any material. After repair, the system shall be retested.
8. A "leak" shall be defined as a formation of bubbles observed when a soap solution is applied or as indicated by the criteria for double walled HDPE piping in Paragraph B. 5. below.
9. Upon satisfactory completion of the test, the pressure shall be slowly released.

**B. Special Procedural Requirements for Doubled Walled HDPE Piping**

1. Cap off the inner pipe and the containment annulus separately and provide pressure gauges on each end of the inner pipe and each end of the annulus. (Four gauges).
2. Using low-pressure compressed air, charge the annular space to the lesser of approximately one-half of the test pressure or 2.5 pounds per square inch gauge (psig) at which time a preliminary check of the system shall be conducted.

3. Thereafter, the pressure shall be gradually increased in increments of approximately one-tenth of the test pressure. The incremental pressure shall be held long enough to equalize the system, until the test pressure (10psig) is attained.
4. The test pressure shall be maintained for a minimum of 2 hours.
5. In a tight system, the containment gauge should read 5 psi (minus losses due to expansion), and the carrier gauge should be zero. If there is a leak in the containment piping, the containment gauge will begin to drop. If, however, there is a leak in the carrier piping, the inner piping will become pressurized.
6. If a leak is detected, the leak shall be located and the leaking section shall be replaced. The leak detection procedure shall be repeated until satisfactorily completed at no cost to the Lead PRP.
7. Upon satisfactory completion of the test, the system shall be slowly depressurized.

## ATTACHMENT 1

### HYDROSTATIC AND PNEUMATIC TEST DATA SHEET

Project Number:

Project Name:

Piping System/Equipment:

Description of Piping System/Equipment Being Tested:

Reference Criteria:

Type of Test:

Test Medium:

Operating Pressure:

Operating Temperature:

Test Pressure:

Test Temperature:

Examination Pressure:	Examination Temperature:
Minimum Holding Time at Test Pressure:	Minimum Holding Time at Examination Pressure:
Allowable Leakage:	

Pressure Test Gauge(s)                      Identification Number: \_\_\_\_\_

Calibration Due Date: \_\_\_\_\_

Test Relief Valve(s)                      Identification Number: \_\_\_\_\_

Calibration Due Date: \_\_\_\_\_

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**PRETEST RELEASE SIGN-OFF**

Mechanical      Eng. \_\_\_\_\_      Date: \_\_\_\_\_      Supt: \_\_\_\_\_      Date: \_\_\_\_\_

Welded Joints      Eng. \_\_\_\_\_      Date: \_\_\_\_\_      Supt: \_\_\_\_\_      Date: \_\_\_\_\_

Instrumentation      Eng. \_\_\_\_\_      Date: \_\_\_\_\_      Supt: \_\_\_\_\_      Date: \_\_\_\_\_

Time Test Started:	Time Test Completed:



Comments:

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Performed by		Witnessed by Client	
Name:	Date:	Name:	Date:
Verified by		Witnessed by the CQA Consultant	
Name:	Date:	Name:	Date:

**SECTION 04080**  
**STEEL PROCESS PIPING**

**PART 1- GENERAL**

**1.01 SECTION INCLUDES**

- A. This section covers furnishing and installing all steel piping, fittings, accessories, and supports, etc., with the exception of any piping which is an integral part of any equipment assembly and which would be furnished by the manufacturer. Flushing and testing requirements for installed steel piping are specified in Sections 04060-04070.
- B. Where piping connects to equipment, particular care shall be taken to see that pipe fittings are suitable for connection to the equipment fittings.

**1.02 RELATED SECTIONS**

- A. Related Sections are listed below:
  - 1. Section 04060 – Flushing and Testing
  - 2. Section 04070 – Leak Testing Of Piping

**1.03 CITED STANDARDS**

- A. All steel piping and fittings shall conform to the following standard Specifications, of the latest revisions, as applicable:
  - 1. ASME/ANSI B16.3 - 1998 - Malleable Iron Threaded Fittings
  - 2. ASME/ANSI B16.4 - 1998 - Cast Iron Threaded Fittings
  - 3. ASME/ANSI B16.5 - 2003 - Pipe Flanges and Flanged Fittings
  - 4. ASTM A53 / A53M - 07 Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
  - 5. ANSI B36.10 2004 Welded and Seamless Wrought Steel Pipe

**1.04 NOTED RESTRICTIONS – NONE**

**1.05 QUALITY CONTROL**

- A. Manufacturers for piping shall be firms regularly engaged in manufacture of pipes and pipe fittings of types and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.

## **1.06 SUBMITTAL**

- A. Product Data: Submit manufacturer's technical product data, installation instructions, and dimensioned drawings for each type of pipe and pipe fitting. Submit piping schedule showing manufacturer, pipe or tube weight, fitting type, and joint type for each piping system.

## **PART 2- PRODUCTS**

### **2.01 STEEL PROCESS PIPING**

- A. The steel pipe shall consist of welded or seamless carbon steel type in accordance with ANSI B36.10 and shall be Schedule 40, unless otherwise specified.
- B. Pipe sizes, joints, wall thicknesses, (or thickness schedule), shall be as indicated in the Pipe Schedule and/or on the drawings.
- C. Flanged Joints
  - 1. Where flanged pipe is required, the flanges shall be ANSI 150 lb. Flanges may be screwed on using tapered pipe threading, weld neck, or slip-on welded. All flange gaskets on the piping shall be constructed of Kel-F or Teflon.
  - 2. Steel pipe flanges shall conform to ANSI B16.5 "Steel Pipe Flanges and Flanged Fittings". Steel flanges shall be raised face except when bolted to flat face cast iron flange.
  - 3. Flanged joints shall be made with bolts, bolt studs with nut on each end, or studs with nuts where the flange is tapped. The number and size of bolts shall conform to the same ANSI Standard as the flanges.
  - 4. Gaskets for flat face flanges shall be full face type. Gaskets for raised face flanges shall conform to requirements for "Group I

Gaskets" in ANSI B16.5. Gaskets shall be  $\frac{1}{8}$  in. thick min. and of Kel-F or Teflon.

5. Bolting

- a. Bolting for services up to 500°F shall be ANSI/ASTM A307 Grade B with square head bolts and heavy hexagonal nuts conforming to ANSI B18.2.1 "Square and Hex Bolts" and B18.2.2 "Square and Hex Nuts". Bolt studs and studs shall be of the same quality as machine bolts.
- b. Set flange bolts beyond finger tightness with an indicating torque wrench to insure equal tension in all bolts. Tighten bolts such that those 180 degrees apart or directly opposite are torqued in sequence.

D. Threaded Joints (where necessary)

1. Where threaded pipe is required, screwed fittings shall be Grinnell, Providence, RI, or equal. Where Fittings shall be long radius type such as manufactured by Tube Turns Technologies, Louisville, KY, or equal.
2. Pipe screw threads to conform to ANSI B2.1.

**PART 3- EXECUTION**

**3.01 PREPARATION – NONE**

**3.02 INSTALLATION**

- A. Installation of steel piping shall be per the manufacturer's recommendations.
- B. The maximum spacing between pipe supports for steel, cast iron, or ductile iron shall be in accordance with the following table.

Steel (Std. Weight or heavier)  Cast Iron, Ductile Iron	Max. Spacing	
	Steam & Liquids	Air & Gases
1 ½ " and smaller	7'-0"	7'-0"
2" - 3"	10'-0"	14'-0"
4" - 6"	14'-0"	20'-0"
8" and above	20'-0"	20'-0"

- C. Additional supports shall be provided where the following occurs:
  - 1. where the pipe changes direction.
  - 2. adjacent to flanged valves and strainers.
  - 3. at equipment connections and heavy fittings.
- D. The Contractor shall provide at least one hanger adjacent to each joint in cast-iron soil pipe and grooved-end steel pipe with mechanical couplings.
- E. Vertical pipe runs shall be supported and laterally braced at every floor level in multistory structures and at intervals not exceeding 15 ft in other structures.

### 3.03 FLUSHING AND TESTING

- A. Installed piping shall be flushed and tested as per the manufacturer's specifications and the Specifications contained in Sections 04060 and 04070. Testing shall be performed before heat tracing.

### END OF SECTION

## **SECTION 04090**

### **PLASTIC PROCESS PIPING**

#### **PART 1- GENERAL**

##### **1.01 SECTION INCLUDES**

- A. This specification outlines the requirements for Polyvinyl Chloride (PVC) pipe. This pipe meets and or exceeds the industry standards and requirements as set forth by the American Society for Testing and Materials (ASTM) and the National Sanitation Foundation (NSF International).

##### **1.02 REFERENCED SECTIONS**

- A. Related Sections are listed below:
  - 1. Section 04060 – Flushing and Testing
  - 2. Section 04070 – Leak Testing Of Piping

##### **1.03 CITED STANDARDS**

- A. All plastic process piping shall adhere to the following standards, or latest revisions of, as applicable:
  - 1. ASTM D1784 – 08 Standard Specification for Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds
  - 2. ASTM D1785 – 06 Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120
  - 3. ASTM D 3034 Standard Specification for Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings
  - 4. AWWA C900-07, AWWA Standard for Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4 In. Through 12 In. (100 mm Through 300 mm), for Water Transmission and Distribution
  - 5. ANSI/AWWA C905-08, AWWA Standard for Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 14 In. Through 48 In. (350 mm Through 1,200 mm), for Water Transmission and Distribution

6. ASTM D 2321 Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications
7. National Sanitation Foundation (NSF International STD 61, STD 14)

#### **1.04 NOTED RESTRICTIONS**

- A. This pipe is intended for use in applications where the fluid conveyed does not exceed 140°F.
- B. Threaded connections are not recommended for PVC pipe at temperatures above 110°F. The Contractor shall use flanged joints, unions, or roll grooved couplings where disassembly is necessary at elevated temperatures.

#### **1.05 QUALITY CONTROL**

- A. PVC Pipe Product Marking
  1. For all PVC Piping, product marking shall meet the requirements of ASTM D1785 and shall include:
    - a. the manufacturer's name (or manufacturer's trademark when privately labeled).
    - b. the nominal pipe size.
    - c. the material designation code.
    - d. the pipe schedule and pressure rating in psi for water @ 73°F
    - e. the ASTM designation D1785.
    - f. the independent laboratory's seal of approval for potable water usage.
    - g. the date and time of manufacture.
- B. The Contractor shall protect existing site improvements from damage during installation of above and underground pipeline.

## **1.06 SUBMITTALS**

- A. The Contractor shall submit copies of the manufacturer's product specifications. Submittal shall at a minimum include nominal pipe size, wall thickness.

## **PART 2- PRODUCTS**

### **2.01 SCHEDULE 80 PVC PIPE**

- A. All pipe shall be manufactured by one of the following, or an equal approved by the Engineer.
  - 1. Harvel® Plastics, Inc., Easton, PA
  - 2. J-M Pipe, Livingston, NJ
  - 3. Hunter Engineered Plastics, Lincoln, AL
  - 4. National Pipe Co., Vestal, NY
- B. The material used in the manufacture of the pipe shall be domestically produced rigid polyvinyl chloride (PVC) compound, Type I Grade I, with a Cell Classification of 12454 as defined in ASTM D1784.
- C. The pipe shall be manufactured in the USA, using domestic materials, by an ISO 9001 certified manufacturer. This compound shall be gray in color as specified, and shall be approved by NSF International for use with potable water (NSF Std 61).
- D. Dimensions
  - 1. PVC Schedule 80 pipe shall be manufactured in strict accordance to the requirements of ASTM D1785 for physical dimensions and tolerances. Each production run of pipe manufactured in compliance to this standard, shall also meet or exceed the test requirements for materials, workmanship, burst pressure, flattening, and extrusion quality defined in ASTM D1785.
  - 2. All belled-end pipe shall have tapered sockets to create an interference-type fit, which meet or exceed the dimensional requirements and the minimum socket length for pressure-type sockets as defined in ASTM D2672.



3. All PVC Schedule 80 pipe must also meet the requirements of NSF Standard 14 and CSA Standard B137.3 rigid PVC pipe for pressure applications, and shall bear the mark of listing agencies.
4. This pipe shall have a flame spread rating of 0-25 when tested for surface burning characteristics in accordance with CAN/ULC-S102-2-M88 or equivalent.
5. Schedule 80 PVC Pipe Dimensions are shown in the table below (pipe sizes shown in strict compliance with ASTM D1785).

**Schedule 80 Dimensions (1/8" – 4")**

<b>Nom. Pipe Size (in)</b>	<b>O.D.</b>	<b>Avg. I.D.</b>	<b>Min. Wall</b>	<b>Nom. Wt./Ft.</b>	<b>Max. Working Pressure (PSI)</b>
1/8"	0.405	0.195	0.095	0.063	1230
1/4"	0.540	0.282	0.119	0.105	1130
3/8"	0.675	0.403	0.126	0.146	920
1/2"	0.840	0.526	0.147	0.213	850
3/4"	1.050	0.722	0.154	0.289	690
1"	1.315	0.936	0.179	0.424	630
1-1/4"	1.660	1.255	0.191	0.586	520
1-1/2"	1.900	1.476	0.200	0.711	470
2"	2.375	1.913	0.218	0.984	400
2-1/2"	2.875	2.290	0.276	1.500	420
3"	3.500	2.864	0.300	2.010	370
3-1/2"	4.000	3.326	0.318	2.452	350

4"	4.500	3.786	0.337	2.938	320
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**Schedule 80 Dimensions (5" – 24")**

<b>Nom. Pipe Size (in)</b>	<b>O.D.</b>	<b>Avg. I.D.</b>	<b>Min. Wall</b>	<b>Nom. Wt./Ft.</b>	<b>Max. Working Pressure (PSI)</b>
5"	5.563	4.768	0.375	4.078	290
6"	6.625	5.709	0.432	5.610	280
8"	8.625	7.565	0.500	8.522	250
10"	10.750	9.493	0.593	12.635	230
12"	12.750	11.294	0.687	17.384	230
14"	14.000	12.410	0.750	20.852	220
16"	16.000	14.213	0.843	26.810	220
18"	18.000	16.014	0.937	33.544	220
20"	20.000	17.814	1.031	41.047	220
24"	24.000	21.418	1.218	58.233	210

**E. Pressure Rating**

- The pressure ratings below are for water, non-shock, @ 73°F. The following temperature de-rating factors are to be applied to the working pressure ratings (WP) listed when operating at elevated temperatures.

Operating Temp (°F)	De-Rating Factor
73	1
80	0.88
90	0.75
100	0.62
110	0.51
120	0.4
130	0.31
140	0.22

2. Multiply the working pressure rating of the selected pipe at 73°F, by the appropriate de-rating factor to determine the maximum working pressure rating of the pipe at the elevated temperature chosen.

a. Example: To solve **10" PVC SCH 80 @ 120F**

10" PVC SCH 80 @ 73°F = 230psi

De-Rating Factor @ 120°F = 0.4

Answer: 230 psi x 0.40 = **92 psi max. @ 120F**

#### F. Joints and Threads

1. Solvent-cemented joints should be utilized when working at or near maximum temperatures. Threaded connections are not recommended for PVC pipe at temperatures above 110F. The Contractor shall use flanged joints, unions, or roll grooved couplings where disassembly is necessary at elevated temperatures.

2. Thread only Schedule 80 or heavier PVC walls. ***Threading requires a 50% reduction in pressure rating stated for plain end pipe @73F.*** Threading of Schedule 40 PVC pipe is not a recommended practice due to insufficient wall thickness

## **PART 3- EXECUTION**

### **3.01 PREPARATION**

- A. The Contractor shall inspect each pipe and fitting prior to installation to ensure that there are no damaged portions of the pipe. Damaged pipe shall be replaced with new undamaged sections of pipe.

### **3.02 INSTALLATION**

- A. Before placement of the pipe in the trench, each pipe or fitting shall be thoroughly cleaned of any foreign substance which may have collected thereon and shall be kept clean at all times thereafter. For this purpose, the openings of all pipes and fittings in the trench shall be closed during any interruption to the Work. As pipe laying progresses, the Contractor shall keep the pipe interior free of all debris. The Contractor shall completely clean the interior of the pipe of all sand, dirt, rocks and any other debris following completion of pipe laying prior to testing, disinfecting and placing the completed pipeline in service.
- B. Pipe shall be laid directly on the bedding material. No blocking will be permitted and the bedding shall be such that it forms a continuous, solid bearing for the full length of the pipe. Bell holes shall be formed at the ends of the pipe to prevent joint loading at the bells or couplings.
- C. Where necessary to raise or lower the pipe grade due to unforeseen obstructions or other causes, the Contractor may change the alignment and/or the grades following approval from the CQA Consultant. Such change shall be made by the deflection of joints or by the use of additional fittings. However, in no case shall the deflection in the joint exceed the maximum deflection recommended by the pipe manufacturer.
- D. No pipe shall be installed upon a foundation into which frost has penetrated or any time that there is a danger of the formation of ice or penetration of frost at the bottom of the excavation. No pipe shall be laid

unless it can be established that the trench will be backfilled before the formation of ice and frost occurs.

- E. Immediately before jointing bell and spigot pipe, both the bell and spigot end of the pipe shall be thoroughly cleaned and lubricated with an approved vegetable-based lubricant. The spigot end of the pipe section shall then be inserted into the bell of the previously laid joint and telescoped into its proper alignment. Tilting of the pipe to insert the spigot into the bell will not be permitted.
- F. Solvent-welded and heat-fused joints shall be carefully and thoroughly cleaned immediately before joining the pipe. Particular care shall be taken in making solvent-welded joints to ensure a uniform, homogeneous and complete bond.

### **3.03 TESTING**

- A. Testing shall be performed per the Manufacturer's recommendations and in accordance with the requirements of Sections 04060 and 04070.

**END OF SECTION**

## **SECTION 04100**

### **HDPE PROCESS PIPING**

#### **PART 1- GENERAL**

##### **1.01 SECTION INCLUDES**

- A. This section includes a description of how the Contractor shall address the construction practices that relate to single-wall and double-walled high-density polyethylene (HDPE) piping.

##### **1.02 REFERENCED SECTIONS**

- A. Related Sections are listed below:
  - 1. Section 04060 – Flushing and Testing
  - 2. Section 04070 – Leak Testing Of Piping

##### **1.03 CITED STANDARDS**

- A. All HDPE piping shall conform to the requirements of the following standard Specifications, of the latest revisions, as applicable:
  - 1. ASTM F714 Standard Specification for Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Outside Diameter
  - 2. ASTM D 3350 Standard Specification for Polyethylene Plastics Pipe and Fittings Materials
  - 3. ASTM D 3261 Standard Specification for Butt Heat Fusion of Polyethylene Plastic Fittings for Polyethylene Plastic Pipe and Tubing
  - 4. ASTM D 2837 Standard Test Method for Obtaining Hydrostatic Design Basis for Thermoplastic Pipe Materials
  - 5. ASTM D 2657 Standard Practice for Heat Fusion Joining of Polyolefin Pipe and Fittings
  - 6. ASTM D 2321 Standard Practice for Underground Installation of Flexible Thermoplastic Sewer Pipe

7. ASME B16.5 Pipe Flanges and Flanged Fittings NPS 1/2 through NPS 24
8. ASME B16.21 Nonmetallic Flat Gaskets for Pipe Flanges
9. ASME B31.3 Process Piping
10. Occupational Safety and Health Administration - Code of Federal Regulations (CFR) Title 29 Part 1910
11. Occupational Safety and Health Administration - CFR Title 29 Part 1926
12. Standard Specifications for Public Works Construction (Green Book)

#### **1.04 NOTED RESTRICTIONS**

- A. Hot gas welding shall not be allowed for wetted components.
- B. All installed piping shall be flushed and tested as per the Specifications in Section 04060 and Section 04070.

#### **1.05 QUALITY CONTROL**

- A. Fusion machine heater plate surface temperatures and hydraulic cylinder interface pressures shall be recorded during the butt fusion joining operations. Measurements shall be permanently recorded utilizing a McElroy Datalogger or other approved by the CQA Consultant. Results shall be provided to the CQA Consultant.
- B. The Contractor shall ensure that the persons joining the HDPE have been trained in the pipe manufacturer's recommended procedures.
- C. It is the sole responsibility of the Contractor to construct a pipeline capable of passing the leak tests. Failure of a pipeline segment to pass leak testing shall be repaired at no cost to the Lead PRP.
- D. The supplier shall submit, in writing, that the pipe furnished under this specification is in conformance with the material and mechanical requirements specified.
- E. HDPE Pipe System

1. All material and fittings furnished under this specification shall be from a manufacturer who has been regularly engaged in the design and manufacture of HDPE piping for at least 5 years.
2. The HDPE piping system, including fittings and custom fabrications, shall be supplied by a single manufacturer approved by the CQA Consultant.
3. Pipe that has been tested by the manufacturer and falls outside the appropriate limits set forth in these Specifications shall be rejected for use on this project.
4. The HDPE pipe manufacturer shall submit Quality Assurance / Quality Control (QA/QC) records to the Contractor.

#### **1.06 SUBMITTALS**

- A. Pipe fabrication drawings shall be submitted to the CQA Consultant before beginning the fabrication of the pipe. Pipe fabrication drawings shall include (but not be limited to) the following information:
  1. Manufacturer/Supplier (Supplier).
  2. Type, grade, and thickness of HDPE pipe.
  3. Joint detail.
  4. Method of joint assembly.
  5. Details of flanges, dished heads, and outlets, including size and type to be utilized.
  6. Complete material lists, which shall include all required hardware to assemble pipe.
  7. Pipe fusion requirements.
  8. Pipe bedding requirements and the Supplier's proposed method of construction.
  9. Pipe closure pieces and jumper pipe assemblies.
  10. Manufacturer's recommended pressure test procedure.



- B. The Contractor shall submit all necessary shop drawings, vendor data, dimensional data, and inspection reports to the CQA Consultant.
- C. Fusion Joint Technician Certification
  - 1. The certified fusion technician used for the work shall be certified and trained in the proper use of fusion equipment and manufacturer's recommended procedures.
  - 2. The Contractor shall submit a written certification to the CQA Consultant from the HDPE pipe suppliers that the proposed pipe fusion method(s) and equipment are appropriate for use on the project and on the supplied HDPE pipe.
- D. Fusion bonding machine recorded parameters shall be submitted to the CQA Consultant within 2 days following the completion of any joint. Failure to submit this information may result in the joint being rejected and replaced.
- E. The Contractor shall provide a comprehensive project work plan and schedule 15 days before the start of HDPE pipe installation at the project site.

#### **1.07 PROTECTION OF WORK AREA**

- A. The Contractor shall be familiar with possible/potential utilities that may impact construction work, shall verify the possible locations for all underground utilities before beginning excavation work for pipe installation, and shall protect existing site improvements from damage during construction of underground pipeline.

#### **PART 2- PRODUCTS:**

##### **2.01 SINGLE WALL HIGH-DENSITY POLYETHYLENE PIPE (HDPE)**

- A. All single wall HDPE pipe shall be SDR 17, unless otherwise indicated on the Drawings. Leachate Collection Pipe is a perforated 6-in diameter single wall HDPE pipe. Perforation pattern is provided in the Drawings. Force Main for the underground storage tank located at the northwest corner (NW Tank) of the site is a solid 4-in diameter single wall HDPE pipe within the edge of waste. Force Main for the underground storage tank located at the

southeast corner (SE Tank) of the site is a solid 2-in diameter single wall HDPE pipe within the edge of waste.

- B. Polyethylene pipe shall be manufactured only from HDPE virgin compounds. All piping system components (i.e., pipe, fittings, reducers, etc.) shall be of the same material and shall be the product of one manufacturer such as ISCO Industries, LLC or an approved equal. All piping system components shall also be made in the USA.
- C. The pipe and fittings shall be homogeneous throughout and free from visible cuts, cracks, holes, blisters, voids, foreign inclusions, or other defects that are visible to the naked eye and that may affect the wall integrity. Damaged sections of piping shall not be repaired. Damaged sections of piping shall be cut out and replaced per the manufacturer's procedures and recommendations.
- D. Pipe shall be uniform in color, opacity, density, and other physical properties, and free from tacky or sticky material.
- E. HDPE pipe shall be manufactured in accordance with the requirements of ASTM F714 and AWWA C906.
- F. HDPE solid wall pipe shall be made from a plastic compound meeting the requirements of Standard PE Code Designation PE-3408 as defined by ASTM D2837 and ASTM D3350.
- G. HDPE pipe shall be SDR 17 and have a pressure rating of 100 psi at 73.4 degrees Fahrenheit.
- H. Exposed HDPE pipe shall be marked with a PURPLE LONGITUDINAL STRIPE extruded into the outer diameter of the pipe.
- I. Flushing and hydrostatic testing shall be performed for the piping. Please refer to Section 04060-04070.

## **2.02 HDPE FITTINGS**

- A. Fittings shall be molded or fabricated from the same material as the pipe, and designed for butt fusion attachment to the pipe.
  - 1. Molded fittings shall be manufactured in accordance with ASTM D3261 and shall be so marked. Each production lot of

molded fittings shall be subjected to the tests required by ASTM D3261.

- B. Polyethylene fabricated fittings for elbows, tees, crosses, wyes, etc., shall be molded or fabricated by the pipe manufacturer.
  - 1. Butt fusion outlets shall be made to the same outside diameter or externally reinforced wall thickness, tolerances, and the internal pressure service equivalent to match the full service pressure as the mating pipe.
  - 2. Pressure de-rated fabricated fittings shall not be permitted.
- C. Molded fittings shall be manufactured in accordance with ASTM D3261, and so marked. Each production lot of molded fittings shall be subject to the test required under ASTM D3261.
- D. Polyethylene flange adapters shall be made with sufficient through-bore length to be clamped in a butt fusion-joining machine without the use of a stub-end holder. The sealing surface of the flange adapter shall be machined with a series of small V-shaped grooves to provide gasket-less sealing, or to restrain the gasket against blowout.

## **2.03 DOUBLE WALL HIGH-DENSITY POLYETHYLENE PIPE (HDPE)**

- A. General
  - 1. All double wall HDPE pipe shall be SDR 17, unless otherwise indicated on the Drawings. Leachate Transmission Pipe is a double wall solid HDPE pipe consisting of 6-in diameter inner pipe and 10-in diameter outer pipe. Force Main for the NW Tank is a double wall solid HDPE pipe consisting of 4-in diameter inner pipe and 8-in diameter outer pipe outside of the edge of waste. Force Main for the SE Tank is a double wall solid HDPE pipe consisting of 2-in diameter inner pipe and 4-in diameter outer pipe outside of the edge of waste
  - 2. The double-walled HDPE pipe shall be ISCO Dual Containment HDPE Pipe as manufactured by ISCO Industries, Louisville, KY or another manufacturer approved by the Engineer.

3. The Contractor shall be responsible for the overall operation of the complete system, and the Contractor shall be responsible for the acceptable condition of the containment piping. No deviation from this specification shall be allowed without express written consent of the Engineer.

B. Materials

1. The pipe and fittings shall conform to ASTM D-3350 with minimum cell classification values of 345464C. The pipe and fittings shall be made from the same polyethylene resin base which meets this specification.
2. Pipe and Fittings
  - a. The pipe used to fabricate the piping system supplied under this specification shall be high density, extra high molecular weight polyethylene pipe.
  - b. The pipe and fittings shall conform to ASTM D-3350 with minimum cell classification values of 345464C. The pipe and fittings shall be made from the same polyethylene resin base which meets this specification.
  - c. Fittings shall be manufactured to the same SDR as the pipe. This shall be verified by the Contractor to make sure that fittings do not de-rate the piping system.
  - d. All molded and fabricated fittings shall meet the pressure requirements of the system as specified and based on ASTM D2837 Hydrostatic Design Basis for Thermoplastic Pipes.
  - e. All molded fittings shall be manufactured per ASTM D3261. Pipe joints and fittings shall be supplied to the job site ready for simultaneous butt-fusion.
  - f. The pipe and fitting manufacturer shall provide documentation that the fabricator/welders have a minimum of 2 years experience fabricating dual containment systems and shall show compliance with ASTM C 1147.

## **2.04 DOUBLE WALL HDPE FITTINGS (DOGBONES™)**

- A. Force Transfer Dogbones™ shall be used to anchor the differential and the total forces from thermal expansion / contraction for double wall HDPE pipe. The Force Transfer Dogbones™ shall be mass anchor machined from solid high density polyethylene pipe grade resin. The coupling shall anchor the inner carrier pipe and the outer containment pipe to an external anchor point. Force Transfer Dogbones™ shall be used to protect fittings from thermal expansion as required by the manufacturer's thermal analysis of the system based on the standards outlined in this specification.
- B. Force Transfer Dogbones™ shall simultaneously be fused into the system. Solid Force Transfer Dogbones™ shall be used to segment the annular space as required.
- C. Force Transfer Dogbones™ shall be ported unless indicated on the Drawings. Ports shall provide a continuous annular space and match the openings in the centralizers. Ports must be positioned properly during installation.
- D. End termination/Force Transfer Dogbones™ shall be used to seal the system at both ends. The coupling shall be simultaneously butt fused to the carrier and containment pipe to seal the annular space. No other closure or termination will be allowed. This fitting will also provide the transition to single wall piping.
- E. Tie-ins to other piping systems and/or equipment where butt-fusion is not applicable shall be with HDPE flange adapters and coated metal back-up rings, unless otherwise specified by the on the Drawings. Mechanical compression or clamp style fittings will not be allowed under this specification.
- F. Additional Force Transfer Dogbones™ shall be used for transition between different pipeline sizes and double wall HDPE piping systems. A machine adapter shall be used to butt fuse the walls of the different pipe.

## **2.05 REDUCERS**

- A. It is the Contractor's responsibility to provide reducers of a material similar to that of the connected system. The size of a reducer may not be shown because the equipment has not been specifically chosen at the time

the Drawings were made. Therefore, in all cases, the Contractor must choose reducers of a size to suit the requirements.

## **2.06 PIPE SLEEVES (LINK SEAL)**

- A. The Contractor shall provide, size, and locate all sleeves such that they be set and/or installed prior to pouring of concrete.

## **PART 3- EXECUTION**

### **3.01 PREPARATION**

- A. The Contractor shall carefully inspect the installed work of all other sections and verify that all work is complete to the point where the work of this Section may properly commence without adverse impact.
- B. If the Contractor has any concerns regarding the installed work in other sections, the Lead PRP shall immediately be notified in writing prior to the start of work of this Section.
- C. Installers shall be pre-qualified through sufficient training in butt fusion techniques according to ASTM D2657 Section 9.
- D. The Manufacturer's Representative shall provide on-site training in the assembly, installation and operation of double wall HDPE pipe systems.

### **3.02 INSTALLATION**

- A. All piping shall be installed in accordance with the manufacturer's recommended procedures.
- B. Handling
  - 1. Pipe and accessories shall be handled in a manner suitable to ensure delivery in a sound, undamaged condition. Slings for handling the pipeline shall not be positioned at butt-fused pipe joints or fitting joints to prevent stressing the fused joints.
  - 2. The interior of the pipe and accessories shall be thoroughly cleaned of foreign matter before being installed and shall be kept clean during the operations.
- C. Placing

1. Pipe and accessories shall be assembled to avoid twisting or damage to the pipe. Under no circumstances shall any of the materials be dropped or dumped.
2. HDPE Pipe and fittings shall be thoroughly cleaned before they are installed. Every precaution shall be taken to prevent foreign material from entering the pipe while it is being placed. The entrance of any material into pipe will not be permitted. During laying operations, no debris, tools, clothing or other materials shall be placed in the pipe. All open pipe ends shall be capped at the end of the work day to prevent foreign material from entering the pipe.
3. Pipe sections shall be joined together on a firm ground. Kinking or excessive bending of the pipeline when laying pipe or making subsequent joints shall be avoided. Pipe shall not be bent more than the minimum radius recommended by the manufacturer for type, grade, and SDR. Care shall be taken to avoid imposing excessive force on pipe and joints at all times.
4. Pipe and fittings shall be laid accurately to the lines and grades indicated on the Drawings.
5. Pipelines in trenches shall be brought to the correct alignment and supported with a firm bedding along the entire length of pipe. The pipe shall be secured in place with Trench Backfill or Pipe Bedding, and tamped under and around it.

D. Joining Methods

1. Lengths of pipe shall be assembled into suitable installation lengths by the butt-fusion process. Thermal fusion shall be conducted only by persons who have received training and are certified in the use of the fusion equipment that is intended for use on this project. The selected fusion equipment shall conform to the equipment recommended by the pipe manufacturer.
2. Before butt fusing HDPE pipe, each length shall be inspected for the presence of dirt, sand, mud, shavings and other debris. Any foreign material shall be completely removed.

3. Pipe and fittings shall be thoroughly cleaned before they are placed. Ends of pipe and pipe joints shall be wiped clean and any burrs removed immediately before joining the pipes.
4. Pipe and fittings shall be jointed in accordance with the recommendations of the manufacturer, consistent with the latest ASTM standards. Branch saddle fusions shall be made in accordance with the manufacturer's recommendations and procedures.
5. HDPE pipe fusion equipment shall be of the size and nature to adequately weld all HDPE pipe sizes and fittings necessary to complete the project. All welders shall have appropriate certifications. No pipe shall be laid until such certification is submitted and accepted by the CQA Consultant.
6. Fusion machine heater plate surface temperatures and hydraulic cylinder interface pressures shall be recorded during the butt fusion joining operations. Measurements shall be permanently recorded utilizing a McElroy Datalogger or other approved by the CQA Consultant. Results shall be provided to the CQA Consultant.
7. Seepage collar shall be extrusion welded around Leachate Transmission Pipes per details provided in the Drawings.

E. Pipe Supports

1. Piping shall be continuously supported throughout the piping system.
2. If at all necessary, additional supports shall be provided at the following locations:
  - a. where pipe changes direction.
  - b. adjacent to flanged valves and strainers.
  - c. equipment connections and heavy fittings.



### **3.03 FLUSHING AND TESTING**

- A. Installed piping shall be flushed and tested as per the manufacturer's specifications and the Specifications contained in Sections 04060 and 04070.

### **3.04 CLEAN-UP**

- A. The interior and exterior of the pipelines shall be cleaned after assembly. Prior to pipe closure, the Contractor shall leave the pipe section full of depressurized water.

**END OF SECTION**

## **SECTION 04110**

### **COMMON WORK RESULTS FOR PROCESS VALVES**

#### **PART 1- GENERAL**

##### **1.01 SECTION INCLUDES**

- A. This section covers furnishing, installing, and testing (where required), of all valves which would be furnished by the manufacturer(s).

##### **1.02 REFERENCED SECTIONS - NONE**

##### **1.03 CITED STANDARDS**

- A. All valves shall comply to the following standards, or latest revisions of, as applicable:
  - 1. ANSI B16.10 - Face-to-Face and End-to-End Dimensions of Ferrous Valves
  - 2. MSS-25 - Standard Marking System for Valves, Fittings, Flanges and Unions

##### **1.04 NOTED RESTRICTIONS**

- A. No asbestos shall be used in the manufacture of any valve component.

##### **1.05 QUALITY CONTROL**

- A. The Contractor shall provide all valves as specified herein and as shown on the Drawings. The Contractor shall submit for approval by the CQA Consultant a schedule of all valves indicating the service, size, and connections, make, model number and any special features such as chain wheel operators, etc.
- B. The Contractor shall furnish and install the specified valves, complete in place, all in accordance with the standard Drawings and as described in these Specifications.
- C. Manufacturer's Qualifications: Only firms, who are regularly engaged in manufacture of valves, of types and sizes required, whose products have been in satisfactory use in similar service, shall be used.
- D. Valve Types: Provide valves of same type by same manufacturer.

- E. Valve Identification: Provide valves with manufacturer's name (or trademark) and pressure rating clearly marked on valve body.
- F. All valves shall be subject to inspection at the place of manufacture, in accordance with the provisions of the referenced standards, as supplemented by the requirements herein.

## **1.06 SUBMITTALS**

- A. The Contractor shall provide all valves as specified herein and as shown on the Drawings. The Contractor shall submit for approval by the CQA Consultant a schedule of all valves indicating the service, size, and connections, make, model number and any special features such as chain wheel operators, etc.
- B. Product Data: Submit manufacturer's technical product data, including installation instructions for each type of valve. Include pressure drop curve or chart for each type and size of valve.
- C. Shop Drawings: Submit manufacturer's assembly-type (exploded view) shop drawings for each type of valve, indicating dimensions, weights, materials, and methods of assembly of components.
- D. Maintenance Data: Submit maintenance data and spare parts list for each type of valve. Include this data, product data, and shop drawings.

## **PART 2- PRODUCTS**

### **2.01 VALVES**

- A. All valves shall be manufacturer's standard, of the design which the manufacturer recommends for the service intended. Each valve shall bear the maker's name or trademark or reference symbol to indicate the service conditions for which it is guaranteed.
- B. All packing, gaskets, discs, seats, diaphragms, lubricants, etc., shall conform to recommendations of the valve manufacturer for the intended service.
- C. Unless otherwise stated in the Specifications, the valve operating mechanisms shall be supplied by the valve manufacturer. This shall include handwheels, levers, gear boxes, and pneumatic and electric

operators and positioners. The available torque shall be greater than twice the normal turning torque and shall also be greater than the seating or unseating torque.

### **PART 3- EXECUTION**

#### **3.01 PREPARATION – NONE**

#### **3.02 INSTALLATION**

- A. The Contractor shall install all valves as per the Drawings, the manufacturer's directions and the Specifications contained herein.
- B. Valves shall be installed with the stems positioned in the horizontal or above the centerline of the pipe. Operators shall be positioned so that they do not interfere with pedestrian traffic. In passageways or above platforms the minimum clearance between the floor and the lowest protruding point on the valve or operator shall be 6 ft 8 in. All valves shall be accessible for operation, maintenance or removal. Valves shall be arranged to open counterclockwise by handwheel or lever operation unless otherwise indicated in these Specifications. Valve operators, which are 7 ft 0 in. or more above the operating floor or platform shall be chain wheel operated. Where necessary for operations as described above, valves shall be bevel or spur gear operated. Plug valve 6 in. and larger shall be gear operated.
- C. If screw end valves are recommended by the Lead PRP and are to be used, all screw end valves shall be threaded according to the American Standard for Pipe Threads No. B2.1.
- D. Flange end valves shall have connecting end flanges in accordance with the Series of the American Standards Association for type valves covered in the Standard.
- E. Positioners or actuators shall be given special support where they overhang from the valve or where the total valve, actuator and position weight is excessive for the size of pipeline.
- F. The placement of valves, instruments and other components shall be located such that they can be easily serviced.

- G. Associated buried valves with nut operators and access vaults shall be installed per the manufacturer's recommendations.

### **3.03 TESTING**

- A. Installed piping and valves shall be flushed and tested as per the manufacturer's specifications and the Specifications contained in **Sections 04060-04070**.

**END OF SECTION**

## **SECTION 04120**

### **STAINLESS STEEL PROCESS VALVES**

#### **PART 1- GENERAL**

##### **1.01 SECTION INCLUDES**

- A. This section lists the stainless steel valves which shall be used for this project.

##### **1.02 REFERENCED SECTIONS**

- A. Section 04110 – Common Work Results for Process Valves

##### **1.03 CITED STANDARDS**

- A. All parts shall conform to the requirements of the following standard specifications, of the latest revisions, as applicable:
  - 1. ASTM A351 – Standard Specification for Castings, Austenitic, for Pressure-Containing Parts
  - 2. ANSI B16.5 – Standard Specification for Pipe Flanges and Flanged Fittings
  - 3. ASTM B16.34 – Standard Specification for Valves – Flanged, Threaded, and Welding End

##### **1.04 NOTED RESTRICTIONS - NONE**

##### **1.05 QUALITY CONTROL - NONE**

##### **1.06 SUBMITTALS**

- A. Refer to Section 04110 – Common Work Results for Process Valves

#### **PART 2- PRODUCTS**

##### **2.01 BALL VALVES**

- A. Stainless Steel Ball Valves shall adhere to the following::
  - 1. Ball Valves ½” – 8”

- a. Body: per ASTM A351-CF8M
- b. Ball is 316SS, Stem is 316 SS
- c. Seals: ME PTFE / Teflon
- d. End Connection: 150 lb ANSI flanged (ANSI B16.5)
- e. Working pressure sufficient to design requirements indicated in drawings.
- f. The valves shall Valtorc Series 180 (150#), or equal approved by the Engineer.

## **2.02 SWING CHECK VALVES**

A. Stainless Steel Swing Check Valves shall adhere to the following::

- 1. Ball Valves ½” – 12”
  - a. Body and Disc: per ASTM A351-CF8M
  - b. End Connection: 150 lb ANSI flanged (ANSI B16.5)
  - c. Working pressure sufficient to design requirements indicated in drawings.
  - d. Pressure/ Temperature ratings shall be in accordance with ASME/ASTM B 16.34.
  - e. The valves shall Valtorc Series 410 or equal approved by the Engineer.

## **PART 3- EXECUTION**

### **3.01 PREPARATION**

- A. The Contractor shall examine areas and conditions where valve is to be installed.

### **3.02 INSTALLATION**

- A. The Contractor shall install the valves in accordance with the manufacturer's installation instructions.

### **3.03 TESTING**

- A. Installed piping and valves shall be flushed and tested as per the manufacturer's specifications and the Specifications contained in Sections 04060-04070.

**END OF SECTION**



## **SECTION 04130**

### **PLASTIC AND PLASTIC LINED PROCESS VALVES**

#### **PART 1- GENERAL**

##### **1.01 SECTION INCLUDES**

- A. This section lists the plastic and plastic lined valves which shall be used for this project.

##### **1.02 REFERENCED SECTIONS**

- A. Section 04110 – Common Work Results for Process Valves

##### **1.03 CITED STANDARDS – NONE**

##### **1.04 NOTED RESTRICTIONS – NONE**

##### **1.05 QUALITY CONTROL – NONE**

##### **1.06 SUBMITTALS**

- A. Refer to Section 04110 – Common Work Results for Process Valves

#### **PART 2- PRODUCTS**

##### **2.01 BALL VALVES**

- A. The Contractor shall furnish and install the following valves:
  - 1. Ball Valve (Sizes 1” – 6”)
    - a. The valves shall be Type 21 PVC as manufactured by ASAHI or the Engineer-approved equal.
  - 2. 4” Gate Valve
    - a. The valves shall be Spears Manufacturing model 2021-040SR or the Engineer-approved equal.

## **2.02 DOUBLE CONTAINMENT BUTTERFLY VALVE**

A. The Contractor shall furnish and install the following valves:

1. DC Butterfly Valve (Sizes 2" X 4" – 4" X 8")

a. The valves shall be P.E. Valve, L.L.C. Time Saver© Dual Containment Butterfly Valves.

## **2.03 CHECK VALVES**

A. The Contractor shall furnish and install the following valves:

1. HDPE Check Valve (Sizes 2" – 4")

a. The valves shall be P.E. Valve, L.L.C. Time Saver© Check Valves.

## **PART 3- EXECUTION**

### **3.01 PREPARATION**

A. The valves shall be examined for defects by the Contractor.

### **3.02 INSTALLATION**

A. Installation shall be performed per the manufacturer's recommendations.

### **3.03 TESTING**

A. Installed piping and valves shall be flushed and tested as per the manufacturer's specifications and the Specifications contained in Sections 04060-04070.

**END OF SECTION**

## **SECTION 04140**

### **AIR RELIEF VALVES (AIR RELEASE WITH VACUUM CHECK)**

#### **PART 1- GENERAL**

##### **1.01 SCOPE**

- A. This specification is intended to cover the design, manufacture, and testing of 1 in. (25.4 mm) through 2 in. (50.8 mm) Air Release Valves with Vacuum Check suitable for pressures up to 500 psig (5100 kPa) clean water or raw water service.
- B. Air Release Valves with Vacuum Check shall be automatic float operated valves designed to exhaust large quantities of air during the filling of a piping system and close upon liquid entry. The valve shall provide a vacuum check to prevent air from entering the system when it is under vacuum. The valve shall also release accumulated air from a piping system while the system is in operation and under pressure.

##### **1.02 REFERENCED SECTIONS**

- A. Section 04110 – Common Work Results for Process Valves

##### **1.03 CITED STANDARDS**

- A. All air relief valves shall conform to the requirements of the following standard specifications, of the latest revisions, as applicable:
  - 1. ANSI/AWWA C512-07, AWWA Standard for Air-Release, Air/Vacuum, and Combination Air Valves for Waterworks Service
  - 2. Valves used in potable water service shall be certified to NSF/ANSI 61 Drinking Water System Components – Health Effects
  - 3. Manufacturer shall have a quality management system that is certified to ISO 9001 by an accredited, certifying body.

##### **1.04 NOTED RESTRICTIONS**

- A. Non-metallic floats, linkage, or bushings are not acceptable.

## **1.05 QUALITY CONTROL**

- A. The manufacturer shall demonstrate a minimum of five (5) years of experience in the manufacture of air valves. When requested, the manufacturer shall provide test certificates, dimensional drawings, parts list drawings, and operation and maintenance manuals.
- B. The exterior of the valve shall be coated with a universal alkyd primer.
- C. Cross Contamination and Security Protection
  - 1. All Air (Release, Vacuum, etc.) Valves installed in vaults or flood prone locations shall include an inflow preventer to prevent the introduction of contaminated water through the air valve outlet.
  - 2. The inflow preventer shall allow the admittance and exhausting of air while preventing contaminated water from entering during normal operating conditions. The inflow preventer shall be flow tested by an independent third party to certify performance. The third party shall be an approved testing lab of the American Society of Sanitary Engineers.

## **1.06 SUBMITTALS**

- A. Refer to Section 04110 – Common Work Results for Process Vavles

## **PART 2- PRODUCTS**

### **2.01 COMBINATION AIR VALVE**

- A. The Air Release Valves with Vacuum Check shall be APCO Model 200A 1” NPT (single body) as manufactured by APCO-Willamette Valve and Primer Corporation, Schaumburg, IL, USA or another approved by the Engineer.
- B. The valve body and cover shall be constructed of Cast Iron, ASTM A126 Grade B with stainless steel lever pin, float lever and float; Brass orifice seat and BUNA-N needle.

## **PART 3- EXECUTION**

### **3.01 PREPARATION**

- A. The air relief valves shall be examined for defects by the Contractor.

### **3.02 INSTALLATION**

- A. Installation shall be performed per the manufacturer's recommendations.

### **3.03 TESTING**

- A. Installed piping and valves shall be flushed and tested as per the manufacturer's specifications and the Specifications contained in Sections 04060-04070.

**END OF SECTION**

## **SECTION 04200**

### **LEVEL PROCESS MEASUREMENT DEVICES (TANK LEVEL SENSORS)**

#### **PART 1- GENERAL**

##### **1.01 SECTION INCLUDES**

- A. This section describes the Contractor's responsibilities for furnishing and installation of level pressure transmitters that are used to measure the leachate level in the storage tanks. Each level pressure transmitter shall be calibrated to provide a full scale 4-20ma signal level proportional to the water level in each tank. Each one foot of water column in the tank exerts a pressure of 0.4333 PSI on the diaphragm of the differential pressure transmitter.

##### **1.02 REFERENCED SECTIONS**

- A. Related sections and/or documents are listed below:
  - 1. Section 04300 - Instrumentation and Controls for Process Systems

##### **1.03 CITED STANDARDS – NONE**

##### **1.04 NOTED RESTRICTIONS – NONE**

##### **1.05 SUBMITTALS**

- A. The Contractor shall perform the following:
  - 1. General. Furnish manufacturer's product data, test reports, and material certifications as required. See section 04300 "Instrumentation System Basic Requirements," for additional requirements, all of which apply.
  - 2. Materials List. Submit a detailed pressure sensor equipment bill-of-materials giving quantities, manufacturer's name, catalog part number and vendor name and telephone number.
  - 3. Wiring Diagram. As part of the control schematics submit wiring diagrams showing all power connections, 4-20ma data signals connections and PLC analog I/O module connections. Each

instrument cable will be labeled on both ends with the instruments PID tag name or number.

4. Calibrations. Calibrations will be performed on each level pressure transmitter by the Contractor's trained engineer, technician, or sub-contractor using the manufacturer's written procedures. Two (2) certified reports of the procedures followed and calibrations shall be submitted to the Engineer prior to final system acceptance.
5. Identification. Identify each level pressure transmitter with and an engraved laminated plastic or stainless steel metal tag. The tags will be attached to each device using a tamper-proof stainless steel lanyard. Each tag shall be printed with the appropriate device name and PID tag name or number.

## **PART 2- PRODUCTS**

### **2.01 DIFFERENTIAL PRESSURE LEVEL TRANSMITTER**

- A. Manufacturer.
  1. Omega Engineering
  2. or another product approved by the Engineer.
- B. Specifications.
  1. Shall be Model Px78u7-015GV.

## **PART 3- EXECUTION**

### **3.01 PREPARATION**

All components shall be inspected to be free of defects prior to installation.

### **3.02 INSTALLATION**

- A. The Contractor's trained engineer, technician, or sub-contractor shall install the equipment in the following manner:

1. Install instrumentation in accordance with the manufacturer's written instructions and in compliance with recognized industrial practices.
2. Mount instruments so they may be readily serviced.
3. Mount instruments so that local readouts are readily observable.
4. The Contractor shall install level pressure sensor on the process storage tanks as specified by the engineer.
5. The Contractor shall provide conduit and wiring per the electrical and control drawings.

### **3.03 CALIBRATION**

A. Programming shall be performed as follows:

1. Calibrate each instrument for ranges designated on the Drawings in the field.
2. Adjust the zero offset so that the 4-20ma signal range begins with zero (0) feet of water
3. Calibrate the span range of the 4-20ma signal so the tank levels displayed will match ranges determined in the field.

**END OF SECTION**



## **SECTION 04300**

### **INSTRUMENTATION AND CONTROL FOR PROCESS SYSTEMS**

#### **PART 1- GENERAL**

##### **1.01 SECTION INCLUDES**

- A. This section describes how the Contractor shall provide the labor, tools, equipment and materials necessary to implement general administrative and engineering requirements for a controls and instrumentation installation in accordance with the plans and Specifications.
- B. Work performed by the Contractor's trained engineer, technician, or sub-contractor under this contract shall be to furnish and install complete instrumentation and process controls systems and to provide a fully operating system per the design and in accordance with associated equipment from all other Divisions and Vendors.

##### **1.02 REFERENCED SECTIONS - NONE**

##### **1.03 CITED STANDARDS**

- A. The Contractor shall perform all work in accordance with the applicable requirements of governing agencies having jurisdiction and in accordance with the plans and Specifications herein. The work shall also comply with applicable provisions and recommendations of the following:
  - 1. Instrument Society of America (ISA)
  - 2. National Electrical Code (NEC)
  - 3. National Electrical Manufacturers Association (NEMA)
  - 4. Institute of Electrical and Electronic Engineers (IEEE)
  - 5. American National Standards Institute (ANSI)
  - 6. National Fire Protection Association (NFPA)
  - 7. Underwriters Laboratories (UL)
  - 8. Joint Industrial Council (JIC)
  - 9. International Standards Organization (ISO)

10. American Society for Testing and Materials (ASTM)

11. International Electrotechnical Commission (IEC)

**1.04 NOTED RESTRICTIONS – NONE**

**1.05 SUBMITTALS – See Section 04200**

**1.06 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver equipment properly packaged and mounted on pallets to facilitate handling of heavy items. Utilize fabricated containers or wrappings to protect equipment for damage during shipping and handling.
- B. Coordinate equipment delivery schedules with the CQA Consultant both verbally and in writing. Include shipper documentation and expected on-site delivery dates and times.
- C. Inspect equipment to ensure that no damage has occurred during shipment. Handle equipment carefully to prevent physical damage. Do not install damaged equipment, remove from site and replace with new equipment.
- D. All items shipped to the job site shall be properly stored until they can be installed. Such storage shall meet the requirements of the CQA Consultant. Use all means necessary to protect the equipment during and after installation from both the environment and other trades.

**PART 2- PRODUCTS**

**2.01 SEE SECTION 04200**

**PART 3- EXECUTION**

**3.01 PREPARATION**

- A. All products shall be inspected for defects prior to installation.

**3.02 INSTALLATION**

- A. All products shall be installed in accordance with manufacturer's recommendations.

**END OF SECTION**

# **DIVISION 5 – PROCESS GAS & LIQUID HANDLING, PURIFICATION, AND STORAGE EQUIPMENT**

## **SECTION 05100**

### **COMMON WORK RESULTS FOR PROCESS GAS & LIQUID HANDLING, PURIFICATION, AND STORAGE EQUIPMENT**

#### **PART 1 GENERAL**

##### **1.01 GENERAL CONDITIONS**

- A. The General Conditions apply to all work of this specification, which shall be done as shown on the plans, and as specified, and shall be properly coordinated with work in other Specifications.
- B. The Drawings and these Specifications are complementary to each other; what is called for by one shall be as binding as if called for by both. If there is any conflict between what is shown on the Drawings and what is written in the Specifications, the more restrictive shall take precedence and the Contractor shall communicate the conflicts to the CQA Consultant prior to constructing the work.
- C. Safety
  - 1. The Contractor shall be familiar with, and shall at all times conform to, the regulations of the “*OSHA General Industry Occupational Safety and Health Standards*,” “*OSHA Safety and Health Regulations for Construction*,” and other applicable state and municipal standards and regulations.

##### **1.02 RELATED SECTIONS**

- A. Sections 05110 through 05140.

##### **1.03 CITED STANDARDS – NONE**

##### **1.04 NOTED RESTRICTIONS – NONE**

##### **1.05 QUALITY CONTROL**

- A. The Contractor shall use an adequate number of skilled workmen who are thoroughly trained and experienced in the necessary crafts to perform the work, and who are completely familiar with the specified requirements

and the methods needed for proper performance of the work of this Section.

- B. All equipment specified in this Division shall include a concrete pad of the appropriate strength and thickness for adequate support of equipment as applicable and in accordance with manufacturer's recommendations.

**PART 2 PRODUCTS**

**2.01** See Sections 05110 through 05140.

**PART 3 EXECUTION**

**3.01** See Sections 05110 through 05140.

**END OF SECTION**

## **SECTION 05110**

### **CENTRIFUGAL LIQUID PUMP FOR THE CENTRAL STORAGE TANK**

#### **PART 1 GENERAL**

##### **1.01 SCOPE**

- A. The Section provides a general description for the liquid pump(s) to be used for the above ground central storage tank.

##### **1.02 RELATED SECTIONS**

- A. Section 05130 – Above Ground Central Storage Tank

##### **1.03 CITED STANDARDS**

- A. All liquid transfer pump shall conform to the requirements of the following standard specifications, of the latest revisions, as applicable:
  - 1. ASTM A48/A48M-03 – Standard Specification for Gray Iron Castings.
  - 2. ASTM A108-08 – Standard Specification for Steel Bar, Carbon and Alloy, Cold Finished.

##### **1.04 NOTED RESTRICTIONS – NONE**

##### **1.05 QUALITY CONTROL**

- A. The Contractor shall provide the pump manufacturers with the necessary drawings to make certain that the pump equipment to be installed does not exceed the space allocations designated on the drawings.
- B. All pumps shall operate in the stated capacity, head, and suction lift shown in the manufacturer's specifications with reasonable assurance of freedom from cavitations.
- C. Motors shall be of ample size to operate without overload through the entire range of their designated pump characteristic curve. Ample means of lubrication shall be provided for all bearings and parts where required.

- D. Water seals shall be provided where packing or mechanical seals are provided. Pumps and motors shall perform the work intended without undue wear and undue heating.

#### **1.06 SUBMITTALS**

- A. The submittals required in this section include (but are not limited to) the following:
  - 1. Characteristic pump curves.
  - 2. Materials.
  - 3. Seal descriptions.
  - 4. Impeller diameter.
  - 5. Maximum impeller permissible.
  - 6. NPSH requirements.
  - 7. Operating point.
  - 8. Test results.
  - 9. Electrical characteristics of motors.
  - 10. Outline dimensions.
  - 11. Seal Water requirement.

#### **1.07 DELIVERY AND STORAGE**

- A. All equipment delivered and placed in storage shall be stored with protection from the weather, humidity and temperature variations, dirt and dust, or other contaminants.

## **PART 2      PRODUCTS**

### **2.01    TRANSFER PUMPS FOR THE ABOVE GROUND CENTRAL STORAGE TANK**

- A.    The CONTRACTOR shall provide Goulds® horizontal frame mounted, end suction centrifugal pump units, Model 3196 2x3-8-MTi as manufactured by Goulds® Pump or an equal approved by the Engineer. See Drawings for transfer pump details.
- B.    Controls
  - 1.    Controls shall conform to applicable provisions of the instrumentation and electrical drawings.

## **PART 3      EXECUTION**

### **3.01    PREPARATION**

- A.    The Contractor shall inspect pumps for defects prior to installation.

### **3.02    INSTALLATION**

- A.    Installation shall be performed per the manufacturer's specifications.

### **3.03    TESTING**

- A.    Hydrostatic testing shall be performed for each pump by the manufacturer in accordance with Hydraulic Institute Standards at 250psig. Test results shall be provided to the CQA Consultant.
- B.    Production performance testing will be conducted by the manufacturer on each pump unit. Head at three operating points (70% of Best Efficiency Point (BEP), BEP and 120% of BEP) will be measured at design speed to verify performance. Test results shall be provided to the CQA Consultant.
- C.    Upon installation of all mechanical connections tank shall be filled with water and the working condition of pump shall be checked.

**END OF SECTION**

## **SECTION 05120**

### **SUMP LIQUID PUMPS FOR THE UNDERGROUND TANKS**

#### **PART 1 GENERAL**

##### **1.01 SECTION INCLUDES**

- A. The Section provides a general description for the submersible liquid sump pumps to be furnished and installed by the Contractor for the double wall underground storage tanks.

##### **1.02 RELATED SECTIONS**

- A. Section 05140 – Underground Storage Tanks

##### **1.03 CITED STANDARDS – NONE**

- A. The sump pumps to be installed shall conform to the following standard, or latest revision of, as applicable
  1. ANSI B16.1 - 1998 - Cast Iron Pipe Flanges and Flanged Fittings
  2. American Bearing Manufacturer's Association, Inc. - Standard B-10.
  3. ASTM A48/A48M - 03(2008) - Standard Specification for Gray Iron Castings
  4. Hydraulic Institute, 1983. Standards for Centrifugal, Rotary and Reciprocating Pumps.

##### **1.04 NOTED RESTRICTIONS**

- A. The minimum pump submergence shall always be maintained for the sump pump, as recommend by pump manufacturer.
- B. The Contractor shall be aware that voltage will be present at all terminals on the control when this moisture sensing testing on the pump motor is being performed.



## **1.05 QUALITY CONTROL**

- A. The Contractor shall provide the pump manufacturers with the necessary drawings to make certain that the pump equipment to be installed does not exceed the space allocations designated on the Drawings.
- B. All pumps shall operate in the stated capacity, head, and suction lift as shown in the manufacturer's specifications.
- C. Motors shall be of ample size to operate without overload through the entire range of their designated pump characteristic curve. Ample means of lubrication shall be provided for all bearings and parts where required.
- D. Pump manufacturer shall assume responsibility for pump and motor and ensure satisfactory installation and compatible operation for completely assembled unit.

## **1.06 SUBMITTALS**

- A. The submittals required for the submersible pumps shall include (but are not limited to) the following:
  - 1. Characteristic pump curves.
  - 2. Materials.
  - 3. Seal descriptions.
  - 4. Impeller diameter.
  - 5. Maximum impeller permissible.
  - 6. NPSH requirements.
  - 7. Operating point.
  - 8. Test results.
  - 9. Electrical characteristics of motors.
  - 10. Outline dimensions.
  - 11. Seal Water requirements.

## **1.07 DELIVERY AND STORAGE**

- A. All equipment delivered and placed in storage shall be stored with protection from the weather, humidity and temperature variations, dirt and dust, or other contaminants.

## **PART 2 PRODUCTS**

### **2.01 SUMP PUMP**

- A. The Contractor shall provide two (2) Flygt submersible pumps, or equal approved by the Engineer. See Drawings for sump pump details.
- B. Controls
  - 1. Controls shall conform to applicable provisions of the instrumentation and electrical drawings.

## **PART 3 EXECUTION**

### **3.01 PREPARATION**

- A. The Contractor shall inspect pumps for defects prior to installation.

### **3.02 INSTALLATION**

- A. Installation shall be performed per the manufacturer's specifications.
- B. The Contractor shall install the sump pump level in storage tanks.
- C. The Contractor shall trim cable, piping and cord as required, and adjust controls.
- D. Prior to operating sump pumps, The Contractor shall furnish and install necessary lubricants for proper operation.

### **3.03 TESTING**

- A. Hydrostatic testing shall be performed by the manufacturer and results shall be provided to the CQA Consultant.
- B. Control Testing for Moisture Sensing Components

1. Control testing for moisture sensing components of the pump shall also be tested per the manufacturer's specifications by the Contractor. A normally closed push button and neon indicating lamp shall be provided as part of this testing.
  2. The motor manufacturer shall provide a 330,000 ohm resistor across the probe inside the pump motor to complete this testing. When the test push button is depressed, the neon indicating lamp shall illuminate to indicate the following:
    - a. Power is supplied to the control.
    - b. The control is operative.
    - c. The wiring to the moisture sensing probes in the motor is intact.
  3. The Contractor shall be aware that voltage will be present at all terminals on the control when this testing is performed.
- C. Upon installation of all mechanical connections tanks shall be filled with water and the working condition of pumps shall be checked.

**END OF SECTION**

## **SECTION 05130**

### **ABOVE GROUND CENTRAL STORAGE TANK**

#### **PART 1 GENERAL**

##### **1.01 SCOPE**

- A. This Section includes a description of the above ground central storage tank to be provided and installed by Engineering America, Inc. and how the Contractor shall perform work in regard to the tank that is to be installed.

##### **1.02 RELATED SECTIONS**

- A. Section 05110 – Centrifugal Liquid Pump for Central Storage Tank

##### **1.03 CITED STANDARDS – NONE**

##### **1.04 NOTED RESTRICTIONS – NONE**

##### **1.05 SUBMITTALS**

- A. Provide shop drawings minimum 30 days before planned installation.

#### **PART 2 PRODUCTS**

##### **2.01 ABOVE GROUND CENTRAL STORAGE TANK**

- A. Engineering America is to provide one (1) glass fused to steel Aquastore bolted storage tanks manufactured by CST storage of Dekalb, Illinois and designed per AWWA D103 design standards.
- B. One (1) 14' Diameter X 24' Tall 27,000 gallon tanks (based on 12" of freeboard) with steel floors.

#### **PART 3 EXECUTION**

##### **3.01 INSTALLATION**

- A. Installation of the tank and connections shall be performed by Engineering America's trained personnel regularly engaged in the installation of AQUASTORE storage tanks as manufactured by CST Storage.

### **3.02 TESTING**

- A. The Contractor shall fill the tank with water after the tank installation is completed and all mechanical connections are established. All connections shall be checked for leaks and repaired at no cost to the Lead PRP. Tank shall be filled up to “high level alarm” as defined on the Drawings to check the alarm system.

**END OF SECTION**

## **SECTION 05140**

### **UNDERGROUND STORAGE TANKS**

#### **PART 1 GENERAL**

##### **1.01 SCOPE**

- A. This Section includes a description of the underground double wall storage tanks to be provided and installed by Highland Tank and how the Contractor shall perform work in regard to the leachate tanks that are to be installed.

##### **1.02 RELATED SECTIONS**

- A. Section 05120 – Sump Liquid Pumps for Underground Tank

##### **1.03 CITED STANDARDS – NONE**

##### **1.04 NOTED RESTRICTIONS – NONE**

##### **1.05 SUBMITTALS**

- A. Provide shop drawings minimum 30 days before planned installation.

#### **PART 2 PRODUCTS**

##### **2.01 UNDERGROUND DOUBLE WALL STORAGE TANKS**

- A. Highland Tank is to provide two (2) double walled mild carbon steel welded storage tanks.
  - 1. One (1) 64" Diameter X 15' Long 2,500 gallon.
  - 2. One (1) 96" Diameter X 16' Long 6,000 gallon tank.
- B. Tanks shall be coated with a coal-tar epoxy inside and outside meeting the following standards:
  - 1. Type: Coal-tar epoxy having a minimum volume solids of 68 percent (ASTM D2697)
  - 2. Service Conditions: Buried metal, such as tanks, valves, flanges, bolts, nuts, structural steel, and fittings.
  - 3. Surface preparation: SSPC SP-10.

4. Prime Coat: Ameron 78 HB, 16 mils; Tnemec 46H-413, 16 mils; Porter 7080, 16 mils; or approved equal.
5. Top Coat: Ameron 78 HB, 16 mils; Tnemec 46H-413, 16 mils; Porter 7080, 16mils; or approved equal.

## **PART 3 EXECUTION**

### **3.01 INSTALLATION**

- A. Installation of the tank and connections shall be performed by the Contractor in accordance with manufacturer's recommendations.
- B. Buoyancy due to groundwater shall be considered.

### **3.02 TESTING**

- A. The Contractor shall fill the tank with water after the tank installation is completed and all mechanical connections are established. Connections shall be checked to an extent possible for leaks and repaired at no cost to the Lead PRP. Tank shall be filled up to "high level alarm" as defined on the Drawings to check the alarm system.

**END OF SECTION**

# **DIVISION 6 – METALS**

## **SECTION 06100**

### **COMMON WORK RESULTS FOR METALS**

#### **PART 1- GENERAL**

##### **1.01 SCOPE**

- A. This section includes all labor, materials, equipment, and appliances required to complete Miscellaneous Metal work. The General Conditions apply to all sections of the Specification, which shall be completed as shown on the plans and as specified, and shall be properly coordinated with work in other Specifications.
- B. This section includes the materials, work required to install and where required calculations for the following items:
  - 1. Structural steel and aluminum framing and their associated connections, including stainless steel hardware required for aluminum connections.
  - 2. Structural steel and aluminum welding.
  - 3. Design, furnish and install guardrailings, handrails and railing systems.
  - 4. Design, furnish and install access ladders, framed platforms, stairs and stair nosings.
  - 5. Cast-in-place and post installed anchor bolts for attaching the above items, anchor plates, and embedded items.
- C. This section includes metal fabrications not specifically included in other Sections and required for completion of work as shown on the Drawings and as specified herein.
- D. Furnish labor, materials, equipment and incidentals necessary to install the products specified herein.



- E. The Drawings and these Specifications are complementary to each other; what is called for by one shall be as binding as if called for by both. If there is any conflict between what is shown on the Drawings and what is written in the Specifications, the details described on the Drawings shall take precedence and the Contractor shall communicate the conflicts to the CQA Consultant in a timely manner.
- F. Safety
  - 1. The Contractor shall be familiar with, and shall at all times conform to, the regulations of the “*OSHA General Industry Occupational Safety and Health Standards*,” “*OSHA Safety and Health Regulations for Construction*,” and other applicable state and municipal standards and regulations.

## **1.02 REFERENCED SECTIONS - NONE**

## **1.03 CITED STANDARDS**

- A. All work specified herein shall conform to or exceed the requirements of the Building Code and the applicable requirements of the following documents to the extent that the provisions of such documents are not in conflict with the requirements of this Section.
- B. Products and their delivery, handling and installation shall be in accordance with the following trade standards, codes, or specifications:
  - 1. Aluminum association AA-M32 C22 A41
  - 2. AISC – Specifications and Commentary
  - 3. AISI – Specifications and Commentary
  - 4. ASTM A6: General Requirements for Rolled Structural Steel Bars, Plates, Shapes and Sheet Piling.
  - 5. ASTM A36: Standard Specification for Carbon Structural Steel.
  - 6. ASTM A48 – Specification for Gray Iron Castings
  - 7. ASTM A53 – Specification for Pipe, Steel, Black and Hot-Dipped Zinc-Coated, Welded and Seamless

8. ASTM A123 – Specification for Zinc (Hot-Galvanized) Coatings on Products Fabricated from Rolled, Pressed and Forged Steel Shapes, Plates, Bars and Strips
9. ASTM A153: Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
10. ASTM A276: Standard Specification for Stainless Steel Bars and Shapes.
11. ASTM A240: Standard Specification for heat-resisting chromium and chromium-nickel stainless steel plate, sheet, and strip for pressure vessels.
12. ASTM A307 – Specification for Carbon Steel Externally Threaded Standard Fasteners
13. ASTM A325: Structural Bolts, Steel, Heat Treated 120/105 ksi Minimum Tensile Strength.
14. ASTM A500: Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
15. ASTM A563 – Specification for Carbon and Alloy Steel Nuts
16. ASTM A575 – Specifications for Steel Bars, Carbon, Merchant Quality, M-Grades
17. ASTM A992: Standard Specification for Structural Shapes.
18. ASTM B209: Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
19. ASTM B308: Standard Specification for Aluminum-Alloy 6061-T6 Standard Structural Profiles.
20. ASTM C1107: Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink)
21. ASTM F436: Standard Specification for Hardened Steel Washers.
22. ASTM F593: Standard Specification for Stainless Steel Bolts,

Hex Cap Screws, and Studs.

23. ASTM F594: Standard Specification for Stainless Steel Nuts.
24. ASTM F1554: Standard Specification of Anchor Bolts, steel, 36, 55 and 105-ksi Yield Strength.
25. ASTM F2329: Standard Specification for Zinc Coating, Hot-Dip, Requirements for Application to Carbon and Alloy Steel Bolts, Screws, Washers, Nuts, and Special Threaded Fasteners.
26. American Institute of Steel Construction (AISC) Manual of Steel Construction, Thirteenth Edition.
27. American Welding Society – A2.4: Standard Symbols for Welding, Brazing, and Nondestructive Examination.
28. American Welding Society – D1.1 Structural Welding Code.
29. American Welding Society – D1.2 Structural Welding Code – Aluminum.
30. Aluminum Design Manual–Specifications and Guidelines for Aluminum Structures.
31. ICC-ES Acceptance Criteria 308: Post-installed Adhesive Anchors in Concrete Elements
32. NFPA 101 – Life Safety Code
33. NAAMM – Metal Stairs Manual

**1.04 NOTED RESTRICTIONS - NONE**

**1.05 QUALITY CONTROL**

- A. The metals shall be free from defects impairing strength, durability, and appearances.
- B. Special Inspection of the Work items covered by this Section are required to be performed by the CQA Consultant.
- C. Steel:

1. Conform to codes for arc and gas welding in building construction of AWS and to AISC Specifications. Surfaces to be welded shall be free from loose scale, rust, grease, paint, and other foreign material, except mill scale that will withstand vigorous wire brushing may remain. Perform no welding when base metal is lower than 0 degrees F.
2. Qualify welding operators in accordance with AWS D1.1. Qualification tests shall be run by a recognized testing laboratory acceptable to the Lead PRP at Contractor's expense.

D. Aluminum:

1. Weld with gas metal arc (GMA) or gas tungsten arc (GTA) processes in accordance with AWS.

E. Adhesive Anchors:

1. Adhesive Anchor Installers shall be trained and certified by manufacturer.

**1.06 HANDRAIL, GUARDRAIL AND RAILLING SYSTEM DESIGN CRITERIA**

- A. Design and provide handrail and guardrail system to meet IBC, OSHA and the criteria specified herein. Railing shall be capable of withstanding the following loads without exceeding design allowable stress of materials for handrails, railing anchors and connections.

1. Top rail:
  - a. Uniform load of 50 pounds per foot applied in any direction.
  - b. Concentrated load of 200 pounds applied in any direction at any point.
  - c. Uniform and concentrated loads above need not be assumed to act concurrently.
2. Intermediate rail:

- a. Uniform load of 50 pounds per foot applied in any direction. Uniform load above need not be assumed to act concurrently with loads acting on top rail.
- B. Thermal movements: Provide adequate expansion within the system to allow for thermal expansion and contraction caused by a temperature change of 120 degrees F to -20 degrees F without buckling or warping, opening of joints, overstressing of components, failure of connections and other detrimental effects.
- C. Control of corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.

#### **1.07 SUBMITTALS**

- A. Shop Drawings
  - 1. Submit shop drawings and product data showing materials of construction and details of installation for all items furnished under this Section. Shop drawings shall show sizes of members, method of assembly, anchorage and connection to other members. Shop drawings shall be signed and sealed by the Contractor's Engineer.
- B. Welders Qualifications
  - 1. Welders shall submit certified qualifications for the type of welding being performed.
- C. Test Reports:
  - 1. Submit certified copies of mill test reports on each steel, stainless steel, or aluminum proposed for use, which shows its physical properties and chemical analysis.
- D. Product Data:
  - 1. Manufacturer's catalog sheets on pre-manufactured items.
- E. Calculations:
  - 1. Calculations shall be completed by and sealed by a Professional or Structural Engineer currently registered in the State of

Illinois.

F. Miscellaneous Submittals:

1. Provide current International Code Council (ICC) Engineering Status Reports (ESR) for manufactured items to be used by the Work of this Section. This includes but is not limited to ICC-ESR reports for post installed concrete anchors.

**1.08 DELIVERY STORAGE AND HANDLING**

- A. Package, ship and tag unassembled materials in a manner that will protect materials from damage and will facilitate identification and field assembly.
- B. Package stainless steel items in a manner to provide protection from carbon impregnation.
- C. Protect painted coatings and finishes from damage due to metal banding and rough handling. Use padded slings and straps.
- D. Deliver items to be incorporated into the work of other trades in sufficient time to be checked prior to installation.
- E. Store fabricated items in a dry area, not in direct contact with ground.

**1.09 FIELD MEASUREMENTS**

- A. The Contractor shall verify all dimensions and shall make any field measurements necessary and shall be fully responsible for accuracy and layout of the work.
- B. The Contractor shall review the Drawings and any discrepancies shall be reported to the CQA Consultant for clarification prior to starting fabrication.

**PART 2- PRODUCTS**

**2.01 MATERIALS**

- A. Structural Steel Shapes:
  1. W Shapes: ASTM A992, 50 ksi

2. L Shapes: ASTM A36
3. Plates and Bars: ASTM A36
- B. Stainless Steel Shapes:
  1. All Uses: AISI, Type 304 or Type 316
  2. For Welding: AISI, Type 304L or Type 316L
  3. Shapes and Bars: ASTM A276
  4. Plate, Sheet and Strip: ASTM A240
- C. Aluminum Shapes:
  1. Structural Shapes: ASTM B308, Alloy 6061-T6
  2. Aluminum Sheet and Plate: ASTM B209, Alloy 6061-T6
- D. Aluminum:
  1. Weld with gas metal arc (GMA) or gas tungsten arc (GTA) processes in accordance with AWS.
- E. High Strength Bolts for Steel Members: ASTM A325
- F. Steel Washers ASTM F436
- G. Plain Unhardened Steel Washers: ASTM F844
- H. Cast-In-Place Carbon Steel Anchor Bolts:
  1. Headed bolts and threaded rods: ASTM F1554, Grade 36
  2. Nuts: ASTM A563, Hex, Grade A
  3. Washers: ASTM AF436, Type 1
- I. Hot-dip galvanized parts per ASTM A153, unless otherwise specified.
- J. Stainless Steel Anchor Bolts:
  1. Headed bolts ASTM F593

2. Type 304 or 316, CW1 (5/8" to 3/4" dia)
  3. Type 304 or 316, CW2 (>3/4" dia.)
  4. Threaded rods ASTM A193
  5. Type 304, Grade B8, Class 1
  6. Type 316, Grade B8M, Class 1
  7. Nuts: ASTM F594, Hex, CW1 or CW2
  8. Washers: ASTM A240
  9. Headed anchor studs Type H4L by Nelson Stud Welding, Inc., or approved equivalent.
- K. Carbon or galvanized steel ASTM A108
1. Stainless steel ASTM A276, Type 316L
- L. Galvanizing, hardware: ASTM A153, Zn w/0.5 percent minimum Ni.
- M. Post Installed Anchors
1. Adhesive anchors shall be a two part assembly of threaded rod with nuts and washers and an adhesive product as defined below.
  2. Refer to the Drawings for additional adhesive anchor requirements.
  3. Install adhesive anchors in full compliance with the adhesive manufacturer's recommendations.
  4. Adhesive product shall be Hilti Corporation, HIT-RE 500-SD, or Engineer approved equivalent product.
  5. The threaded rod, washer and nut materials shall be as defined in the above Article's.
- N. Handrail, Guardrail and Railing Systems
1. Material: ASTM B429, alloy 6063-T6, Schedule 80, 1-1/2 inch diameter minimum extruded structural pipe or tube rails and



schedule 80 posts.

2. Railings at open-side construction shall consist of two members with posts. Locate intermediate rails between top rail and finish floor as indicated on Drawings.
3. Provide 1/4-inch thick by 4 inch high or "S" type toe plate except on stairs and where concrete curb is provided. Provide 1/4-inch clearance above floor level. Expansion joint location to match railing joint location.
4. Fabrication:
  - a. Angles, offsets, other changes in alignment, and joining of posts and rails shall be made with welded connections. Miter and weld joints by fitting post to top rail and intermediate rail to post, mitering corners, groove welding joints, and grinding smooth. Run top rails continuously over post.
  - b. Rail splices shall be butted and reinforced by tight fitting interior sleeve not less than 6 inch long.
  - c. Fabricate wall railings with wall brackets for intermediate support and wall return fittings at ends. Brackets and end fittings shall be of cast or formed metal of same material and finish as supported rails and shall be of proper size to provide 3 inch clear space between wall and railing. Provide wall brackets not more than 5 feet on center.
  - d. Provide expansion joint splices at 30 feet maximum spacing, with slip joint internal sleeve extending minimum of 4 inch beyond each side of joint. Weld to one side only. Locate within 12 inch of handrail posts.
  - e. Space handrail posts as shown on approved submittals. Where spacing is not shown, space posts not more than 5 feet on center. Erect posts plumb in each direction.
  - f. Fabricate joints which will be exposed to weather so as to exclude water. Provide weep holes at the lowest possible point on all railing system posts.

5. Railings at walls shall be single member.
  - a. Support wall rails on brackets spaced not more than 5 feet on center and at each end of rail. Cantilevered extensions not allowed.
6. Anchorage:
  - a. Railings: Provide concrete anchorage for posts by means of base flange welded to post and anchored to concrete with minimum of 4 concrete anchors.
7. Finishes:
  - a. Aluminum Association Finish Designation: AA-M12A41 (Mechanical finish, nonspecular, anodic coating, architectural Class I, clear coating 0.7 mil complying with AAMA 607.1 on exposed surfaces.
  - b. Extruded Components: 0.7 mil anodized.
  - c. Cast Components: 0.4 mil anodized.
- O. Corrosion Protection
  1. All miscellaneous steel metalwork shall be hot-dip galvanized after fabrication as specified herein, unless otherwise shown.
- P. Seat Angles and Supports
  1. Seat angles for grating shall be aluminum or stainless steel. All support angles buried, submerged or below top of hydraulic structures shall be stainless steel.
- Q. Power-Driven Pins
  1. Power-driven pins shall not be used unless specifically approved by the Engineer.

## **2.02 FABRICATIONS**

- A. The Contractor shall make the work in ample time so as not to delay the job progress, and shall deliver to the job at such time as required for proper coordination.

- B. The Contractor shall make the joints of such character to be assembled strong and rigid as adjoining sections. The welded joints shall be continuous or spot welds as per best practice of trade. For the continuous welds, ground them smooth for exposed work.
- C. Do the cutting, punching, drilling, and tapping required for the attachment of work coming in contact with the miscellaneous metal work so indicated or where the same directions are given prior to or with the approval of the shop drawings. Do the necessary cutting, drilling, and fitting required for the installation of miscellaneous metal work. Execute the drilling, cutting, and fitting carefully and when required, fit the work at the job before finishing.
- D. All items of miscellaneous metals, except for those encased in concrete, shall receive one shop coat before delivery to the job.
- E. Welding:
  - 1. Provide rigid and continuous welds or spot welded as specified and as shown on the Drawings. Dress the face of welds flush and smooth. Close fit exposed joints and locate where least conspicuous.
  - 2. Weld aluminum work on the unexposed side when possible in order to prevent pitting or discoloration.
  - 3. Weld aluminum in compliance with the latest edition of AWS D1.2. Support and clamp component parts of built-up members in proper position for welding.
  - 4. Weld shop connections and bolt or field weld connections, unless otherwise specified.
  - 5. Grind exposed edges of welds to 1/8-inch minimum radius. Grind burrs, jagged edges, and surface defects smooth.
  - 6. Prepare welds and adjacent areas so there is:
    - a. No undercutting or reverse ridges on weld bead.
    - b. No weld spatter on or adjacent to weld or other area to be painted or coated.
    - c. No sharp peaks or ridges along weld bead.

F. Bolting:

1. Use bolts of lengths required so bolts do not project more than 1/4-inch beyond face of nut. Do not use washers unless specified. Provide hexagonal head bolts with hexagonal nuts.
- G. Provide holes required for connection of adjacent or adjoining work wherever noted on the Drawings. Locate holes for bolting equipment to supports to tolerance of +/- 1/16-inch of dimensions indicated.

**2.03 DISSIMILAR METALS**

- A. Keep surfaces of dissimilar metal from direct contact by coating the dissimilar metal with a heavy coat of a two part epoxy.
- B. Keep surfaces of aluminum components from direct contact with cement or mortar by coating with a heavy coat of a two part epoxy.

**2.04 GROUT AND ANCHORING CEMENT**

- A. Nonshrink, nonmetallic, nonstaining and noncorrosive grout premixed and factory packaged. Provide grout conforming to requirements of ASTM C 1107.

**PART 3- EXECUTION**

**3.01 EXAMINATION**

- A. Upon receipt of material at job site, inspect all materials for shipping damage. Replace damaged items at no cost to the Lead PRP.
- B. Examine supports for size, layout and alignment.
- C. Correct defects in delivered material which the CQA Consultant considers detrimental to proper installation.

**3.02 INSTALLATION**

- A. Fabrication and Installation Requirements
  1. Fabrication and Erection: Except as otherwise shown, the fabrication and erection of structural steel shall conform to the requirements of the American Institute of Steel Construction "Manual of Steel Construction."

2. Steel Railings: Field welding of steel pipe handrail joints will be permitted only if approved by the Lead PRP.

B. Welding

1. Method: All welding shall be by the metal-arc method or gas-shielded arc method as described in the American Welding Society's "Welding Handbook" as supplemented by other pertinent standards of the AWS. Qualification of welders shall be in accordance with the AWS Standards.
2. Quality: In assembly and during welding, the component parts shall be adequately clamped, supported and restrained to minimize distortion and for control of dimensions. Weld reinforcement shall be as specified for the AWS Code. Upon completion of welding, all weld spatter, flux, slag and burrs left by attachments shall be removed. Welds shall be repaired to produce a workmanlike appearance with uniform weld contours and dimensions. All burrs, spatter and sharp corners of material shall be ground smooth prior to coating.

C. Galvanizing

1. All structural steel plates, shapes, bars and fabricated assemblies requiring galvanization shall be thoroughly cleaned of rust and scale before being galvanized. Galvanization shall be in accordance with the requirements of ASTM A123. Any galvanized part that becomes warped during the galvanizing operation shall be straightened. Bolts, anchor bolts, nuts and similar threaded fasteners, after being properly cleaned, shall be galvanized in accordance with the requirements of ASTM A153. Field repairs to galvanizing shall be made using "Galvinox", "Galvo-Weld", or approved equal.

- D. Provide items such as bolts, shims, blocks, nuts, washers, and wedging pieces to complete installation.
- E. Erect to lines and levels, plumb and true, and in correct relation to adjoining Work. Secure parts using concealed connections when practicable.
- F. Plumb and true vertical members to tolerance of +/- 1/8 inch in 10 feet. Level horizontal members to tolerance of +/- 1/8 inch in 10 feet.

- G. Use steel bolts to connect structural steel members. Use stainless steel bolts to connect structural aluminum members.
- H. Cast-In-Place Anchor Bolts and Post Installed Adhesive Anchors:
  - 1. Preset cast-in-place anchor bolts (cast anchor bolts) using templates. Do not use post installed adhesive anchors (adhesive anchors) in place of anchor bolts unless previously approved in writing by the Engineer.
  - 2. After cast anchor bolts are embedded, protect projecting threads by applying grease and having the nuts installed until the time of installation of equipment or metalwork.
  - 3. Do not install adhesive anchors until concrete has reached its specified minimum compressive strength.
  - 4. Install adhesive anchors in accordance with anchor manufacturer's recommendations. Embedment depth of anchor shall be as recommended by the adhesive anchor manufacturer, but not less than as shown on the Drawings, whichever results in a larger embedment.
  - 5. Locate cast anchor bolts and adhesive anchors such that they do not conflict with reinforcing bars in concrete.
- I. Weld headed anchor studs in accordance with manufacturer's recommendations.
- J. Do not place new holes or enlarge holes by use of a cutting torch.

**3.03 HANDRAIL, GUARDRAILING AND RAILING SYSTEM  
INSTALLATION ADDITIONAL REQUIREMENTS**

- A. Install as shown on the Drawings and accepted Shop Drawings.
- B. Set posts plumb and aligned in each direction to within 1/4-inch in 12 feet.
- C. Fit exposed connections together to form tight, hairline joints.
- D. Provide anchorage devices and fasteners for securing handrails and railings and for transferring loads to structures.

- E. Provide mechanical joints for permanently connecting railing components at non-welded connections.

### **3.04 PAINTING, REPAIR, AND PROTECTION**

- A. Coat aluminum surfaces in contact with concrete with a heavy coating of bituminous paint.
- B. Isolate aluminum surfaces in contact with dissimilar metals with rubber or neoprene gaskets, or other means acceptable to the Engineer.
- C. Apply an anti-seize compound on all stainless steel fasteners to prevent galling.
- D. Structural steel framing and connections shall be coated with two part epoxy paint such as Tnemec, Potapox or other coating systems acceptable to the Engineer.
- E. Aluminum and stainless steel framing and connections shall be standard mill finish, unless otherwise requested by the Lead PRP.
- F. Field repair of damaged factory applied coating systems.
  - 1. Touch up abrasions in factory applied coating systems immediately after erection. Field coat areas left bare from the factory for welding with a system identical to the factor applied coating system immediately after welding.
  - 2. Surfaces to receive field applied coatings shall be prepared in accordance with the coating manufacturer's recommendations.

### **3.05 FIELD QUALITY CONTROL**

- A. The CQA Consultant will be performing Special Inspection of the Work associated with this Section. Refer to Part 1.05 for additional requirements.
- B. Contractor shall notify the CQA Consultant of readiness for items under this Section to be inspected a minimum of 5 working days prior to the items being covered by further work. Failure to provide this notification will be cause for delay in placing until observations can be completed.
- C. High strength bolting will be inspected visually. All high strength bolts

shall have the turned portion marked with reference to the steel being connected after the nut has been made snug and prior to final tightening. Retighten rejected bolts or remove and provide new bolts. In cases of disputed bolt installations, the bolts in question shall be checked using a calibrated wrench certified by an independent testing laboratory approved by the CQA Consultant. The certification shall be at no additional cost to the Lead PRP.

### **3.06 CLOSEOUT ACTIVITIES**

- A. Upon notification by the Contractor, the CQA Consultant shall provide one (1) final punchlist inspection of the installed Work. The Contractor shall be responsible for addressing each item noted in the punchlist by the CQA Consultant, prior to the Lead PRP's acceptance of the Work.

**END OF SECTION**



## **SECTION 06150**

### **METAL GRATING STAIRS AND METAL RAILINGS**

#### **PART 1- GENERAL**

##### **1.01 SCOPE**

- A. The Contractor shall provide all labor, materials, equipment and incidentals as shown, specified and required to furnish and install grating, stair treads, frames, and metal railings.

##### **1.02 REFERENCED SECTIONS**

- A. Section 06100 – Common Work Results for Metals.
- B. Related documents are listed below:
  - 1. ASTM A1011/A-04 Standard Specification for Steel Sheet and Strip
  - 2. AISI 1008 Standard Low Carbon Steel
  - 3. ANSI/NAAMM-MBG-531-00 Metal Bar Grating Manual
  - 4. ASTM A-123 Standard Specification for Zinc Hot-Dip Galvanized Products.

##### **1.03 CITED STANDARDS - NONE**

##### **1.04 NOTED RESTRICTIONS – NONE**

##### **1.05 QUALITY CONTROL**

- A. Manufacturer Qualification: A company specializing in the manufacturing of metal bar gratings with not less than 10 years of documented experience.
- B. Comply with applicable provisions and recommendations of the following: NAAMM Metal Bar Grating Manual designated ANSI/NAAMM MBG 531 (Aluminum and Light Duty Steel and Stainless Steel Grating) and MBG 532 (Heavy Duty Steel Grating).
- C. Light Duty Steel: ASTM A1011 for hot rolled carbon steel sheet and strip. ASTM A510 for carbon steel wire rods and coarse round wire.

ASTM A666 for stainless steel.

- D. Take field measurements prior to preparation of final shop drawings and fabrication where required to ensure proper fitting of the work.

## **1.06 SUBMITTALS**

- A. The Contractor shall submit for approval shop drawings for the fabrication and erection of all work. Include plans, elevations, and details of sections and connections. Show type and location of all fasteners.
- B. The Contractor shall submit the manufacturer's specifications, load tables, anchor details and standard installation details.
- C. Samples of grating and anchorage system shall be submitted for approval.

## **PART 2- PRODUCTS**

### **2.01 MATERIALS**

- A. Grating: Swaged Carbon Steel SGCS Series by Ohio Gratings Inc., or equal.
- B. Bearing Bars: Rectangular bar 1-1/2" depth x 3/16" width on a maximum of 15/16" centers. (Note other spacing may be specified at the discretion of the architect/engineer.)
- C. Cross Bars: Carbon steel tubing mechanically locked by swaging at right angles to bearing bars at a maximum of 4" on center. (Note other cross bar spacing may be specified at the discretion of the architect/engineer.)
- D. Surface: Serrated.
- E. Loading: Grating to carry a pedestrian loading equal to a uniform load of 100# per square foot over the required clear span with deflection not to exceed 1/4". (Note: alternate loading requirements may be specified at the discretion of the Engineer.)
- F. Finish: The gratings shall be galvanized after fabrication.
- G. Fabrication and tolerances shall be in accordance with ANSI/ NAAMM

Metal Bar Grating Manual.

**2.02 STEEL PIPE HANDRAILS**

- A. Steel pipe handrails which may be partially or wholly submerged or which are located inside a hydraulic structure shall be entirely of Type 316 stainless steel.
- B. All other steel pipe handrails shall be standard 1 ½ inch black steel pipe made up by welding and hot-dip galvanized.

**PART 3- EXECUTION**

**3.01 INSTALLATION**

- A. Prior to grating installation, Contractor shall inspect supports for correct size, layout and alignment. Any inconsistencies between Drawings and supporting structure deemed detrimental to grating placement shall be reported in writing to the architect or Lead PRP's agent prior to placement.
- B. Install grating in accordance with shop drawings and standard installation clearances as recommended by ANSI / NAAMM Metal Bar Grating Manual.
- C. Protection of Aluminum from Dissimilar Materials:
  - 1. Where aluminum surfaces come into contact with dissimilar metals, surfaces shall be kept from direct contact by painting the dissimilar metal with one coat of bituminous paint or other approved insulating material.
  - 2. Where aluminum surfaces come into contact with dissimilar materials such as concrete, masonry or lime mortar, exposed aluminum surfaces shall be painted with one coat of bituminous paint or other approved insulating material.

**3.02 CUTTING, FITTING AND PLACEMENT**

- A. Perform all cutting and fitting required for installation. Grating shall be placed such that cross bars align.
- B. Wherever grating is pierced by pipes, ducts and structural members, cut openings neatly and accurately to size and weld a rectangular band bar

of the same height and material as the bearing bars.

- C. Cutouts for circular obstructions are to be at least 2" larger in diameter than the obstruction.
- D. Utilize standard panel widths wherever possible.

#### **GRATING ATTACHMENT**

- A. Use approved attachment system and fasteners to secure grating to supporting members as shown on plans.

**END OF SECTION**

**SECTION 06170**  
**METAL GRATINGS**

**PART 1- GENERAL**

**1.01 SCOPE**

- A. This Section describes the metal gratings that are to be used for the project. The Contractor shall furnish and install all metal gratings as per the Specifications contained herein.

**1.02 REFERENCED SECTIONS**

- A. Section 06100 – Common Work Results for Metals.

**1.03 CITED STANDARDS**

- A. Metals gratings shall conform to the following standard specifications, of the latest revisions, as applicable:
  - 1. ASTM A 123/A 123M Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products

**1.04 NOTED RESTRICTIONS – NO ADDITIONAL REQUIREMENTS**

**1.05 QUALITY CONTROL**

- A. Metal grating shall be of the design, sizes and type shown on the drawings. Aluminum in contact with other metal or concrete shall have the contact surface be heavily coated with an alkali-resistant bituminous paint before installation. The bituminous paint shall be Koppers Bitumastic Black Solution, International: Intertuf 100, Tnemec 46-465 HB Tnemecol, or approved equal. The paint shall be applied as it is received from the manufacturer without the addition of any thinner, and the surface shall be cleaned according to the manufacturer's instructions. No less than two coats shall be applied. All exposed surfaces shall be cleaned of any coating before installation. Coatings shall be continuous and holiday free.
- B. Unless otherwise indicated on the drawings, grating over an opening shall cover entire opening.

## **PART 2- PRODUCTS**

### **2.01 STEEL GRATINGS**

- A. Steel Gratings shall be manufactured by McNichols Co. "HWC" Heavy-Weld, IKG Borden Industries "HW" Heavy-Weld, or another approved by the Engineer.
- B. Gratings shall be hot-dip galvanized in accordance with ASTM A 123.
- C. Steel Gratings shall have a bar size and spacing determined by the manufacturer to enable grating to support the live load indicated on the plans, using an extreme fiber stress of not more than 18,000 pounds per square inch.
- D. Maximum deflection under loading shall be  $1/240$  of grating clear span.
- E. The maximum spacing shall be  $1-1/8$  inches clear between bars.
- F. The Contractor shall submit calculations from the grating manufacturer showing that the grating will meet the load-bearing and deflection provisions of the Specifications for each size of grating and for each span. The Contractor shall, if requested by the Lead PRP, test under full load one section of each size of grating for each span length involved on the job, to show compliance with these Specifications. A suitable dial gauge shall be provided by the Contractor for measuring deflections. Grating shall be fabricated in units which do not exceed 500 pounds each.

## **PART 3- EXECUTION**

### **3.01 PREPARATION**

- A. Make cutouts in grating where required for equipment access or protrusion, including valve operators or stems, and gate frames.
- B. Band ends of grating and edges of cutouts in grating.

### **3.02 INSTALLATION**

- A. For installation of metal gratings, the Contractor shall adhere to the following:
  - 1. End Banding:  $1/4$  inch less than height of grating, with top of

grating and top edge of banding flush.

2. Cutout Banding: Full-height of grating.
  3. Use banding of same material as grating.
  4. Panel Layout: Enable installation and subsequent removal of grating around protrusions or piping.
  5. Openings 6 Inches and Larger: Lay out grating panels with edges of 2 adjacent panels located on centerline of opening.
  6. Openings Smaller than 6 Inches: Locate opening at edge of single panel.
- B. Where an area requires more than 1 grating section to cover area, the Contractor shall clamp adjacent grating sections together at  $\frac{1}{4}$  points with acceptable fasteners. Provide stops in grating rebates, between adjacent panels so that panels will not move if adjacent panels are removed.

### **3.03 TESTING**

- A. When requested by the Lead PRP, test one section of each size grating for each span length involved on the job under full load.
1. Furnish a suitable dial gauge for measuring deflections.
  2. Submit test reports as specified under General Provisions

**END OF SECTION**

## **SECTION 06180**

### **MISCELLANEOUS METAL SUPPORTS AND POSTS**

#### **PART 1- GENERAL**

##### **1.01 SCOPE**

- A. This Section describes the metal pipe supports and stanchions that are to be used for the project. The Contractor shall furnish and install all metal pipe supports and stanchions as per the Drawings and the Specifications contained herein.

##### **1.02 REFERENCED SECTIONS**

- A. Section 06100 – Common Work Results for Metals.

##### **1.03 CITED STANDARDS - NONE**

##### **1.04 NOTED RESTRICTIONS – NONE**

#### **PART 2- PRODUCTS**

##### **2.01 METAL PIPE STANCHIONS**

- A. Metal pipe stanchions shall be Schedule 40 bolted down with Hilti Kwik Bolts or approved equal.

##### **2.02 GUIDE POSTS**

- A. Metal guide posts (bollards) shall be 8" diameter schedule 40 steel pipe.
- B. Metal guide posts concrete footers shall be 2' minimum diameter concrete poured against undisturbed earth. Concrete shall be 4,000 psi air entrained concrete.
- C. Finishing
  - 1. Metal guide posts shall be coated with one coat of zinc chromate primer shop paint and two coats of safety yellow field paint per Specifications. Every metal guide post shall receive two strips of 2" white reflective tape .

##### **2.03 METAL PIPE SUPPORTS**

- A. Metal pipe support posts (stanchions) shall be fabricated as specified in the Drawings.



**PART 3- EXECUTION**

**3.01 PREPARATION - NONE**

**3.02 INSTALLATION**

- A. Metal supports and posts shall be installed according to the Drawings.

**END OF SECTION**

## **SECTION 06200**

### **PAINTING AND COATING**

#### **PART 4- GENERAL**

##### **4.01 SCOPE**

- A. This section includes materials and application of painting and coating systems for multiple surfaces such as exposed metal, buried metal, metal in contact with concrete, masonry surfaces, wood surfaces, drywall surfaces, and concrete surfaces.

##### **4.02 REFERENCED SECTIONS**

- A. Section 06100 – Common Work Results for Metals.

##### **4.03 CITED STANDARDS**

- A. All surface preparation, coating, and painting shall conform to the following standard specifications, of the latest revisions, as applicable:
  - 1. Requirements of the Steel Structures Painting Council
  - 2. Requirements of the National Association of Corrosion Engineers
  - 3. the paint manufacturer's printed application instructions

##### **4.04 SUBMITTALS**

- A. The Contractor shall submit shop drawings in accordance with Section 01300 - Submittals.
- B. Submit manufacturer's data sheets showing the following information:
  - 1. Percent solids by volume.
  - 2. Minimum and maximum recommended dry-film thickness per coat for prime, intermediate, and finish coats.
  - 3. Recommended surface preparation.
  - 4. Recommended thinners.
  - 5. Statement verifying that the specified prime coat is recommended by the manufacturer for use with the specified intermediate and finish coats.
  - 6. Application instructions including recommended equipment and temperature limitations.

7. Curing requirements and instructions.
- C. Submit color swatches.
- D. Submit certificate identifying the type and gradation of abrasives used for surface preparation.

#### **4.05 DELIVERABLES**

- A. All materials specified by name, brand, or manufacturer, or selected for use under these specifications shall be delivered unopened at the jobsite in their original containers bearing the manufacturer's label.

### **PART 5- PRODUCTS**

#### **5.01 Painting and Coating Systems**

- A. The following index lists the various painting and coating systems by service and generic type:

1. Exposed Metal Coating Systems

No.	Title	Generic Coating
10.	Exposed Metal, Below Grade	Zinc prime coat, high-build in vaults epoxy intermediate and finish coat
15.	Exposed Metal, Atmospheric Weathering Environment	Zinc prime coat, high-build epoxy intermediate and finish coat

2. Buried Metal Coating Systems

No.	Title	Generic Coating
21.	Buried Metal	Coal-tar epoxy

3. Coating Systems for Nonferrous Metals

- a. Aluminum and Concrete (See Below)

4. These systems are specified in detail in the following paragraphs. For each coating, the required surface preparation, prime coat, intermediate coat (if required), topcoat, and coating thicknesses are described. Mil thicknesses shown are minimum dry-film thicknesses.

- B. Exposed Metal Coating Systems

1. System No. 7 – submerged Metal (Epoxy)
  - a. Type: Epoxy.
  - b. Service Conditions: For use with structures, piping, or equipment immersed in water.
  - c. Surface Preparation: SSPC SP-10.
  - d. Coating System: Apply three or more coats of Tnemec Series 20, Engard 460 HS, or equal; 15 mils total. Color of topcoat: White.
2. System No. 10--Exposed Metal, Corrosive Environment:
  - a. Type: High-build epoxy intermediate and finish coat having a minimum volume solids of 60 percent, with an inorganic zinc prime coat.
  - b. Service Conditions: For use with metal structures or pipes located in vaults, manholes or structures, subjected to water condensation; chemical fumes, such as hydrogen sulfide; salt spray; and chemical contact.
  - c. Surface Preparation: SSPC SP-6.
  - d. Prime Coat: Self-curing, two-component inorganic zinc-rich coating recommended by the manufacturer for overcoating with a high-build epoxy finish coat. Minimum zinc content shall be 14 pounds per gallon. Apply to a thickness of 3 mils. Products: Tnemec 90-97 or equal.
  - e. Intermediate and Finish Coat: Tnemec Series 69 Epoxoline II, 5-mils each coat, or equal.
3. System No. 15 -- Exposed Metal, Atmospheric Weathering Environment:
  - a. Service Conditions: For use on the exterior of metal and piping.
  - b. Surface Preparation: SSPC SP-3.
  - c. Prime Coat: Self-curing, two-component inorganic zinc-rich coating recommended by the manufacturer for overcoating with a high-build epoxy finish coat. Minimum zinc content shall be 14 pounds per gallon. Apply to a thickness of 3 mils. Products: Tnemec 90-97 or equal.

- d. Intermediate and Finish Coat: Tnemec Series 69 Epoxoline II, 5-mils each coat, or equal.

C. Buried Metal Coating Systems

1. System No. 21--Buried Metal:

- a. Type: Coal-tar epoxy having a minimum volume solids of 68 percent (ASTM D 2697).
- b. Service Conditions: Buried metal, such as valves, flanges, bolts, nuts, structural steel, and fittings.
- c. Surface Preparation: SSPC SP-10.
- d. Prime Coat: Ameron 78 HB, 16 mils; Tnemec 46H-413, 16 mils; Porter 7080, 16 mils; or equal.
- e. Topcoat: Ameron 78 HB, 16 mils; Tnemec 46H-413, 16 mils; Porter 7080, 16 mils; or equal.

D. Abrasives for Surface Preparation

- 1. Abrasives used for preparation of iron and steel surfaces shall be one of the following:
  - a. 16 to 30 or 16 to 40 mesh silica sand or mineral grit.
  - b. 20 to 40 mesh garnet.
  - c. SAE Grade G-40 or G-50 iron or steel grit.

E. Organic Zinc Primer for Field Touch-Up and Shop Coating

- 1. Organic zinc coating system shall have a minimum zinc content of 14 pounds per gallon. Coating shall be of the two- or three-component converted epoxy, epoxy phenolic, or urethane type. Products: Tnemec 90-97, or equal; applied to a minimum dry-film thickness of 3 mils. Organic zinc primer shall be manufactured by the prime coat manufacturer.
- 2. Where shop-applied inorganic zinc primers cannot be used because of volatile organic compound (VOC) regulations, the above organic zinc primers may be substituted for the specified inorganic zinc primers.

## **PART 6- EXECUTION**

### **6.01 PREPARATION**

A. Weather Conditions

1. Do not paint in the rain, wind, snow, mist, and fog or when steel or metal surface temperatures are less than 5 degrees F above the dew point.
2. Do not apply paint when the relative humidity is above 80 percent or the temperature is above 90 degrees F.
3. Do not paint when temperature of metal to be painted is above 120 degrees F.
4. Do not apply paint on an exterior or interior surface if air or surface temperature is below 60 degrees F or expected to drop below 60 degrees F in 24 hours.

B. Surface Preparation

1. Do not sandblast or prepare more surface area in one day than can be coated in one day; prepare surfaces and apply coatings the same day. Remove all sharp edges, burrs, and weld spatter. Do not sandblast PVC, CPVC, or FRP piping or equipment. Do not sandblast epoxy- or enamel-coated pipe that has already been factory coated, except to repair scratched or damaged coatings.
2. Surface preparation shall conform with the SSPC specifications as follows:
  - a. Solvent Cleaning SP-1
  - b. Hand Tool Cleaning SP-2
  - c. Power Tool Cleaning SP-3
  - d. White Metal Blast Cleaning SP-5
  - e. Commercial Blast Cleaning SP-6
  - f. Brush-Off Blast Cleaning SP-7
  - g. Pickling SP-8
  - h. Near-White Blast Cleaning SP-10
3. Wherever the words "solvent cleaning," "hand tool cleaning," "wire brushing," or "blast cleaning" or similar words are used in these specifications or in paint manufacturer's specifications, they shall be understood to refer to the applicable SSPC (Steel Structure Painting Council, Surface Preparation Specifications, ANSI A159.1) specifications listed above.

4. Dust blasting is defined as cleaning the surface through the use of very fine abrasives, such as siliceous or mineral abrasives, 80 to 100 mesh. Apply a fine etch to the metal surface to clean the surface of any a contamination or oxide.
5. Remove oil and grease from metal surfaces in accordance with SSPC SP-1. Use clean cloths and cleaning solvents and wipe dry with clean cloths. Do not leave a film or greasy residue on the cleaned surfaces before sandblasting.
6. Remove weld spatter and weld slag from metal surfaces and grind smoothly rough welds, beads, peaked corners, and sharp edges including erection lugs in accordance with SSPC SP-2 and SSPC SP-3.
7. Neutralize welds with a chemical solvent that is compatible with the specified coating materials. Use clean cloths and chemical solvent. Wipe dry with clean cloths. Do not leave a residue on the cleaned surfaces.

C. Procedures for Items Having Shop-Applied Prime Coats

1. After application of primer to surfaces, allow coating to cure for a minimum of two hours before handling to minimize damage.
2. When loading for shipment to the project site, use spacers and other protective devices to separate items to prevent damaging the shop-primed surfaces during transit and unloading. If wood spacers are used, remove wood splinters and particles from the shop-primed surfaces after separation. Use padded chains or ribbon binders to secure the loaded items and minimize damage to the shop-primed surfaces.
3. Cover shop-primed items 100 percent with protective coverings or tarpaulins to prevent deposition of road salts, fuel residue, and other contaminants in transit.
4. Handle shop-primed items with care during unloading, installation, and erection operations to minimize damage. Do not place or store shop-primed items on the ground or on top of other work unless ground or work is covered with a protective covering or tarpaulin. Place shop-primed items above the ground upon platforms, skids, or other supports.

D. Field touch-Up of Shop-Applied Prime Coats

1. Remove oil and grease surface contaminants on metal surfaces in accordance with SSPC SP-1. Use clean rags wetted with a degreasing solution, rinse with clean water, and wipe dry.
2. Remove dust, dirt, salts, moisture, chalking primers, or other surface contaminants that will affect the adhesion or durability of the coating system. Use a high-pressure water blaster or scrub surfaces with a broom or brush wetted with a solution of trisodium phosphate, detergent, and water. Before applying intermediate or finish coats to inorganic zinc primers, remove any soluble zinc salts that have formed by means of scrubbing with a stiff bristle brush. Rinse scrubbed surfaces with clean water.
3. Remove loose or peeling primer and other surface contaminants not easily removed by the previous cleaning methods in accordance with SSPC SP-3. Take care that remaining primers are not damaged by the blast cleaning operation. Remaining primers shall be firmly bonded to the steel surfaces with blast cleaned edges feathered.
4. Remove rust, scaling, or primer damaged by welding or during shipment, storage, and erection in accordance with SSPC SP-3. Take care that remaining primers are not damaged by the blast cleaning operation. Remaining primers shall be firmly bonded to the steel surfaces with blast cleaned edges feathered.
5. Surfaces that are shop primed with inorganic zinc primers shall receive a field touch-up of organic zinc primer to cover all scratches or abraded areas.
6. Other surfaces that are shop primed shall receive a field touch-up of the same primer used in the original prime coat.

E. Painting Systems

1. All materials of a specified painting system, including primer, intermediate, and finish coats, shall be produced by the same manufacturer. Thinners, cleaners, driers, and other additives shall be as recommended by the painter manufacturer for the particular coating system.
2. Deliver paints to the jobsite in the original, unopened containers.

F. Paint Mixing

1. Prepare multiple-component coatings using all of the contents of the container for each component as packaged by the paint manufacturer. Do not use partial batches. Do not use multiple-



component coatings that have been mixed beyond their pot life. Provide small quantity kits for touch-up painting and for painting other small areas. Mix only the components specified and furnished by the paint manufacturer. Do not intermix additional components for reasons of color or otherwise, even within the same generic type of coating.

## **6.02 INSTALLATION**

### **A. Procedures for the Application of Coatings**

1. Conform to the requirements of SSPC PA-1. Follow the recommendations of the coating manufacturer including the selection of spray equipment, brushes, rollers, cleaners, thinners, mixing, drying time, temperature and humidity of application, and safety precautions.
2. Stir, strain, and keep coating materials at a uniform consistency during application. Apply each coating evenly, free of brush marks, sags, runs, and other evidence of poor workmanship. Use a different shade or tint on succeeding coating applications to indicate coverage where possible. Finished surfaces shall be free from defects or blemishes.
3. Do not use thinners unless recommended by the coating manufacturer. If thinning is allowed, do not exceed the maximum allowable amount of thinner per gallon of coating material. Stir coating materials at all times when adding thinner. Do not flood the coating material surface with thinner prior to mixing. Do not reduce coating materials more than is absolutely necessary to obtain the proper application characteristics and to obtain the specified dry-film thicknesses.
4. Remove dust, blast particles, and other debris from blast cleaned surfaces by dusting, sweeping, and vacuuming. Allow ventilator fans to clean airborne dust to provide good visibility of working area prior to coating applications. Remove dust from coated surfaces by dusting, sweeping, and vacuuming prior to applying succeeding coats.
5. Apply coating systems to the specified minimum dry-film thicknesses as measured from above the peaks of the surface profile.
6. Apply primer immediately after blast cleaning and before any surface rusting occurs, or any dust, dirt, or any foreign matter has accumulated. Re-clean surfaces by blast cleaning that have surface colored or become moist prior to coating application.

7. Apply a brush coat of primer on welds, sharp edges, nuts, bolts, and irregular surfaces prior to the application of the primer and finish coat. The brush coat shall be done prior to and in conjunction with the spray coat application. Apply the spray coat over the brush coat.

**B. Surfaces Not To Be Coated**

Do not paint the following surfaces unless otherwise noted on the drawings or in other specification sections. Protect during the painting of adjacent areas:

1. Concrete sidewalks.
2. Mortar-coated pipe and fittings.
3. Stainless steel.
4. Metal letters.
5. Glass.
6. Roofing.
7. Chain link fencing.
8. Copper tubing, red brass piping, and PVC piping except where such piping occurs in rooms where the walls are painted, or required for color coding.
9. Electrical fixtures except for factory coatings.
10. Nameplates.
11. Grease fittings.
12. Brass and copper, submerged.
13. Buried pipe, unless specifically required in the piping specifications.
14. Fiberglass items, unless specifically required.
15. Aluminum handrail, stairs, and grating.

**C. Protection of Surfaces Not To Be Painted**

1. Remove, mask, or otherwise protect hardware, aluminum surfaces, machined surfaces, couplings, shafts, bearings, nameplates on machinery, and other surfaces not intended to be painted. Provide drop cloths to prevent paint materials from falling on or marring

adjacent surfaces. Protect working parts of mechanical and electrical equipment from damage during surface preparation and painting process. Mask openings in motors to prevent paint and other materials from entering the motors.

D. Surfaces To Be Coated

1. Coat Surfaces as described below:

- a. Coat mechanical equipment as described in the various mechanical equipment specifications. Color shall be selected by Lead PRP.
- b. Coat aboveground and exposed piping or piping, except SS and galvanized piping, in vaults and structures as described in the various piping specifications. Color shall be as selected by the Lead PRP.
- c. Coat valves as described in the various valve specifications. Aboveground valves, or valves in vaults and structures, shall match the color of the connecting piping.
- d. Coat aluminum surfaces in contact with concrete per system No. 51.
- e. Coat buried flanges, nuts and bolts, valves, flexible pipe couplings, exposed rebar in thrust blocks, and valve boxes per System No. 24.
- f. Coat aboveground structural steel or structural steel located in vaults and structures as System 15.

E. Dry-Film Thickness Testing

1. Measure coating thickness specified for metal and concrete surfaces with a calibrated magnetic-type dry-film thickness gage. Test the finish coat (except zinc primer and galvanizing) for holidays and discontinuities with an electrical holidays detector, low-voltage, wet-sponge type. Provide measuring equipment. Provide detector as manufactured by Tinker and Razor or K-D Bird Dog. Provide dry-film thickness gage as manufactured by Mikrotest or Elcometer. Check each coat for the correct dry-film thickness. Do not measure within eight hours after application of the coating.
2. Make five separate spot measurements (average of three readings) spaced evenly over each 100 square feet of area (or fraction thereof) to be measured. Make three gage readings for each spot

measurement of either the substrate or the paint. Move the probe a distance of 1 to 3 inches for each new gage reading. Discard any unusually high or low gage reading that cannot be repeated consistently. Take the average (mean) of the three gage readings as the spot measurement. The average of five spot measurements for each such 100 square foot area shall not be less than the specified thickness. No single spot measurement in any 100 square foot area shall be less than 80 percent, nor more than 120 percent, of the specified thickness. One of three readings which are averaged to produce each spot measurement may underrun by a greater amount.

F. Repair of Improperly Coated Surfaces

1. If the item has an improper finish color or insufficient film thickness, clean and topcoat the surface with the specified paint material to obtain the specified color and coverage. Sandblast or power-sand visible areas of chipped, peeled, or abraded paint, feathering the edges. Then prime and finish coat in accordance with the specifications. Work shall be free of runs, bridges, shiners, laps, or other imperfections.

**6.03 TESTING – NONE**